GE Healthcare

Dash™ 3000/4000/5000 Patient Monitor
Service Manual

Dash 3000/4000/5000
English
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2023896-069C (paper)
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NOTE: The information in this manual only applies to Dash 3000/4000 patient monitors with software versions 5.4 and Dash 3000/4000/5000 patient monitors with software versions 6 or later. It does not apply to earlier software versions. Due to continuing product innovation, specifications in this manual are subject to change without notice.

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Contents

1

Introduction 1-1

Manual Information 1-2
Revision History 1-2
Manual Purpose 1-2
Intended Audience 1-2
Ordering Manuals 1-2

Safety Information 1-3
Responsibility of the Manufacturer 1-3
General 1-3
Warnings, Cautions, and Notes 1-4

Equipment Symbols 1-5

Service Information 1-7
Service Requirements 1-7
Equipment Identification 1-7

2

Equipment Overview 2-1

Components 2-2
Monitoring System 2-2
Patient Monitor 2-2
Controls and Indicators 2-5
Exchangeable/Compatible Battery Packs 2-8
Optional Components 2-9
Optional Remote Control 2-12

Software Packages and Software Options 2-13
Software Packages 2-13
Software Options 2-13

Ethernet Communication 2-14
About Ethernet 2-14
Twisted Pair 2-14
Network Terms 2-15

Theory Of Operation **2-16**
Components 2-16
Overall Patient Monitor Block Diagram 2-16
Power Supply 2-17
Data Acquisition System (DAS) 2-17
Processor/Power Management Subsystem 2-26
Lithium-Ion Battery Power 2-34
Speaker 2-39
Handle Subassembly 2-39
Interfaces 2-39
Storage and Backup 2-41
Optional Thermal Printer 2-42

3 **Installation** **3-1**

Installation Overview **3-2**

Before You Begin... . . . . . **3-3**

Connections **3-4**
Back Panel Connections 3-4
Power Up 3-6
Configure 3-6

4 **Configuration** **4-1**

Before You Begin... . . . . . **4-2**

Service Menus **4-3**
Boot Loader Service Menu 4-4
Main Menu Service Mode 4-5

Procedures **4-9**

Set Print Locations **4-10**

Service Mode Settings **4-11**
Set Unit Name 4-11
Set Bed Number 4-11
Patient-Monitor Type 4-12
Admit Menu 4-13
Confirm/Configure Wireless LAN 4-14

Boot Code Settings 4-16
Set Defib Sync Voltage and Pulse Width 4-16
Set Line Frequency 4-16
Set CIC and QS Protocol 4-17
Set MUSE System Protocol 4-17
Transcutaneous Pace Blank Length 4-17
Set Country Selection 4-18
Set Language 4-18
Enable/Disable AFIB Identification 4-19
Enable/Disable IntelliRate 4-19
Analog Out Buzz 4-20
Completion 4-20

Advanced User Procedures 4-21
Procedures 4-21
Set Time and Date 4-21
Transfer Monitor Defaults 4-22

5 **Maintenance 5-1**

Maintenance Schedule 5-2

Visual Inspection 5-3

Cleaning 5-4
Precautions 5-4
Clean the Display 5-4
Clean the Exterior 5-4
Clean the Print Head 5-5

Battery Maintenance 5-6
How to Charge the Battery 5-6
How to Condition the Battery 5-6
How to Store the Battery 5-8
How to Wake Up the Battery 5-8
How to Replace the Batteries 5-10
Rechargeable Battery Recycling 5-10
About the Cadex SMart Two+ Charger 5-11

Clear the Stored Patient Data Memory 5-12

6 Troubleshooting 6-1

Fault Analysis 6-2
Overview 6-2
Required Tools/Equipment 6-2
Problems 6-2
Acquisition PCB Symptoms 6-4
Processor PCB Symptoms 6-4

Error Messages 6-5

Battery Alarms and Messages 6-7
Battery Messages Displayed in the ECG Waveform Area 6-7
Battery Messages Displayed in the Battery Status Information Window 6-8
Battery Messages Displayed in the Battery Fuel Gauge Icon 6-8

Writer/Printer 6-9
External 6-9
Internal 6-9

No Waveform at Central Station 6-10

Monitor Defaults Transfer 6-11
Storing Monitor Defaults 6-11
Copying Stored Monitor Defaults 6-11

Change Internet Address 6-12

Review Errors 6-13
View Output/Input Errors 6-13
Useful Error Data 6-14

Get Error Logs 6-16
Get Logs via PC Using netUpdate 6-16
Get Logs via CIC 6-21
Get Logs via Centralscope 6-21

Wireless LAN 6-24
Access Service Mode 6-24
Identify the Wireless Technology 6-25
802.11b 6-26
802.11 6-29

7

Field Replaceable Units 7-1

Ordering Parts 7-2

Parts 7-3

Disassembly Guidelines 7-7
Tools Required 7-7
Before Disassembly 7-7
Hardware Precautions 7-8
Electrostatic Discharge (ESD) Precautions 7-8

Remove/Replace Handle Assembly 7-9

Remove/Replace Display Assembly 7-12

Replace Display Flex Assembly 7-18

Replace Display Assembly Parts 7-20
Open Display Assembly 7-21
Replace Dash 4000/5000 Alarm Light 7-22
Replace Display Inverter 7-23
Replace Key Pad Assembly or Trim Knob Control 7-24
Replace Display Assembly Without LCD 7-25

Replace Main Unit Parts 7-27
Replace DAS Assembly 7-27
Replace Wireless Card 7-31
Replace NBP Pump Assembly 7-32
Replace Writer Assembly/Writer Flex 7-33
Replace Speaker Assembly 7-34
Replace CPU/Battery Housing Assembly 7-35
Replace Power Supply Assembly 7-37

Replace Battery Door 7-39

Replace Foot 7-40

Replace Writer Cover 7-41

Recommended Checkout 7-42

8 Checkout 8-1

Overview 8-2
Manufacturer Recommendations 8-2
Frequency 8-2
Test Equipment 8-2

Maintenance and Checkout Checklist 8-3
"Visual Inspection" on page 5-3 8-3
"Cleaning" on page 5-4 8-3
"Battery Maintenance" on page 5-6 8-3
"Electrical Safety Tests" on page 8-5 8-3
"Checkout Procedures" on page 8-17 8-4

Electrical Safety Tests 8-5
General 8-5
Recommendations 8-5
Power Outlet Test 8-6
Power Cord and Plug 8-7
Ground (Earth) Integrity 8-8
Ground (Earth) Wire Leakage Current Tests 8-10
Enclosure Leakage Current Test 8-11
Patient (Source) Leakage Current Test 8-12
Patient (Sink) Leakage Current Test (Mains Voltage on the Applied Part) 8-13
BISx (option) Current Leakage Tests 8-14
Test Completion 8-16

Checkout Procedures 8-17
Frequency 8-17
Identify Enabled Patient Parameters and Software Options 8-17
Patient Monitor Power-up Tests 8-18
ECG Tests 8-19
Respiration Tests 8-22
Temperature Tests 8-23
Cardiac Output Tests 8-24
Invasive Blood Pressure Tests (option) 8-26
Pulse Oximetry Tests for GE Ohmeda SPO2 Oximeter 8-30
Pulse Oximetry Tests for Masimo SET SPO2 8-32
Pulse Oximetry Tests for Nellcor OxiMax SPO2 8-34
Noninvasive Blood Pressure Tests 8-36
NBP Calibration 8-38
Analog Output and Defibrillator Synchronization Tests 8-41
End-tidal CO_2 Test (option) 8-44
Battery Tests 8-45
Graph/Print Tests 8-45
Display Test 8-46
Speaker Test 8-46
Network Test (option) 8-47
Remote Control Test (option) 8-47
BISx Test (option) 8-48

Wireless LAN Test (option) 8-50
Dash Port Docking Station Test (option) 8-53
RAC 2A Module Housing Peripheral Device Test (option) 8-53

Data Acquisition Tests 8-54
ECG Functions 8-54
Lead Fail Functions 8-56
Pace Detect Functions 8-56
Invasive Blood Pressure Functions (option) 8-57
Respiration Functions 8-59
Noninvasive Blood Pressure Functions 8-61

Checkout Procedures Completion 8-63
Repair Log 8-64

Appendix A – Technical Specifications A-1

Technical Specifications A-2
Performance Specifications A-2
ECG A-3
Invasive Blood Pressure (BP) A-5
Noninvasive Blood Pressure (NBP) A-5
Bispectral Index (BIS) A-7
GE Pulse Oximetry (SPO2) A-7
Masimo SET SPO2 Module A-7
Nellcor SPO2 Module A-8
Cardiac Output (CO) A-8
Respiration A-9
Temperature (TEMP) A-10
Carbon Dioxide (CO2) A-10
Analog Output A-12
Defibrillator Synchronization Pulse A-12
Battery A-13
Paper Recorder A-13
Wireless LAN A-14
Environmental Specifications A-14
Physical Specifications A-15
Certification A-15

Appendix B– Electromagnetic Compatibility (EMC) B-1

Electromagnetic Compatibility (EMC) B-2
Guidance and Manufacturer's Declaration – Electromagnetic Emissions B-2
Guidance and Manufacturer's Declaration – Electromagnetic Immunity B-3
Guidance and Manufacturer's Declaration – Electromagnetic Immunity B-4
Recommended Separation Distances B-5
Compliant Cables and Accessories B-6

1 Introduction

Manual Information

Revision History

Each page of this manual has the document part number and revision letter at the bottom of the page. The revision letter identifies the document's update level. The revision history of this document is summarized below.

Revision	Comment
A	Initial release of this manual.
B	Added information for 802.11b wireless and BISx. Updated Technical Specifications and Checkout.
C	Added software version 5.4 information where applicable.

Manual Purpose

This manual supplies technical information for service representatives and technical personnel so they can maintain the equipment to the assembly level. Use it as a guide for maintenance and electrical repairs considered field repairable. Where necessary the manual identifies additional sources of relevant information and technical assistance.

See the operator's manual for the instructions necessary to operate the equipment safely in accordance with its function and intended use.

Intended Audience

This manual is intended for service representatives and technical personnel who maintain, troubleshoot, or repair this equipment.

Ordering Manuals

A paper copy of this manual will be provided upon request. Contact your local GE representative and request the part number on the first page of the manual.

Safety Information

Responsibility of the Manufacturer

GE is responsible for the effects of safety, reliability, and performance only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by GE.
- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.

General

This device is intended for use under the direct supervision of a licensed health care practitioner.

This device is not intended for home use.

Federal law restricts this device to be sold by or on the order of a physician.

Contact GE for information before connecting any devices to the equipment that are not recommended in this manual.

Parts and accessories used must meet the requirements of the applicable IEC/EN 60601 series safety standards, and/or the system configuration must meet the requirements of the IEC 60601-1-1 medical electrical systems standard.

Periodically, and whenever the integrity of the device is in doubt, test all functions.

The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

- use of the accessory in the PATIENT VICINITY; and
- evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 60601-1 and/or IEC 60601-1-1 harmonized national standard.

If the installation of the equipment, in the USA, will use 240V rather than 120V, the source must be a center-tapped, 240V, single-phase circuit.

Warnings, Cautions, and Notes

The terms danger, warning, and caution are used throughout this manual to point out hazards and to designate a degree or level or seriousness. Familiarize yourself with their definitions and significance.

Hazard is defined as a source of potential injury to a person.

DANGER indicates an imminent hazard which, if not avoided, will result in death or serious injury.

WARNING indicates a potential hazard or unsafe practice which, if not avoided, could result in death or serious injury.

CAUTION indicates a potential hazard or unsafe practice which, if not avoided, could result in minor personal injury or product/property damage.

NOTE provides application tips or other useful information to assure that you get the most from your equipment.

Equipment Symbols

NOTE: Some symbols may not appear on all equipment.

ATTENTION: Consult accompanying documents before using the equipment.

In Europe, this symbol means dangerous or high voltage. In the United States, this symbol represents the caution notice below:
To reduce the risk of electric shock, do NOT remove cover (or back). Refer servicing to qualified personnel.

Defibrillator-proof type CF equipment; type CF equipment is specifically designed for applications where a conductive connection directly to the heart is established. The paddles indicate the equipment is defibrillator proof.

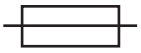
Defibrillator-proof type BF equipment; type BF equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application. Type BF equipment is type B equipment with an F-type isolated (floating) part. The paddles indicate the equipment is defibrillator proof.

Type B equipment; type B equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application.

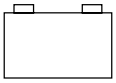
Equipotential Stud: A ground wire from another device can be tied here to ensure the devices share a common reference.

Alternating current (AC)

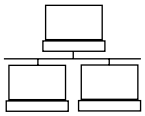
Power; **I** = ON; **O**= OFF



Fuse



Battery



Indicates the Ethernet connection for the patient monitor.

POWER (Dash 3000/4000)

Power (Dash 5000)

Standby (Dash 5000)

Main Display (Dash 5000)

Trend (Dash 5000)

Admit/Discharge (Dash 5000)

Print (Graph Go/Stop on older Dash 3000/4000)

NBP Go/Stop (on older Dash 3000/4000)

NBP Auto (Dash 5000)

Zero All

Silence Alarm/Admit

Medical Equipment
With respect to electric shock, fire and mechanical hazards only in accordance with UL 60601-1, CAN/CSA C22.2 NO. 601.1, IEC 60601-1, IEC 60601-2-27, IEC 60601-2-30. IEC 60601-2-34, and IEC 60601-2-49.

This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

This symbol indicates the date of manufacture of this device. The first four digits identify the year and the last two digits identify the month.

Non-ionizing electromagnetic radiation: To indicate elevated, potentially dangerous, levels of non-ionizing radiation. Note - In case of application in a warning sign the rules according to ISO 3864-1 shall be adhered to.
IEC 60878 note: See safety sign ISO 7010 - W005 "Warning, non-ionizing radiation".

Service Information

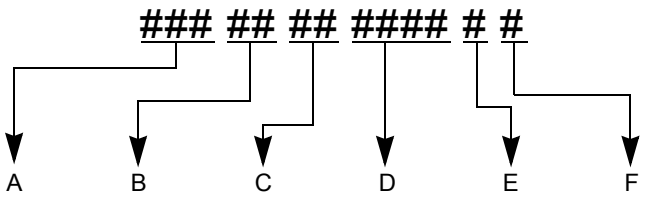
Service Requirements

Follow the service requirements listed below.

- Refer equipment servicing to GE-authorized service personnel only.
- Any unauthorized attempt to repair equipment under warranty voids that warranty.
- It is the user's responsibility to report the need for service to GE or to one of their authorized agents.
- Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
- Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.

Equipment Identification

Every GE device has a unique serial number for identification. A sample of the information found on a serial number label is shown below.



	Description
A	product code[1]
B	year manufactured
C	fiscal week manufactured
D	production sequence number
E	manufacturing site
F	miscellaneous characteristic

1. Current Dash patient monitor product code **SBG**

Dash 3000/4000 patient monitors with **DJ** product code as shown on the sample label below, were shipped from the factory with MPC821 processor board. These patient monitors cannot support software versions later than 5.x.

NOTE

If the MPC821 processor board was replaced with an MPC823 processor board, then the patient monitor can run software version 6 or later. The hardware version can be identified in the Boot Loader program. See "Boot Loader Service Menu" on page 4-4 for steps to access Boot Loader.

2 Equipment Overview

Components

Monitoring System

The Dash patient monitor can function as a portable monitoring device with a built-in writer, or as a flexible care monitoring device connected to the optional Unity Network™ via Ethernet. If using the wireless card or Ethernet connection, optional components are a Clinical Information Center (CIC Pro™) and a Centralscope™ central station.

Patient Monitor

This device is designed to monitor a fixed set of parameters including ECG, noninvasive blood pressure, impedance respiration, SpO2, and temperature. Invasive pressure, BISx, and EtCO2 are optional features. Additional specialized features include cardiac output, cardiac calculations, pulmonary calculations, dose calculations, PA wedge (PA wedge is only available with the invasive pressure option), ICG module interface, and SAM™ module interface.

001C

Dash 3000 Monitor

051D

Dash 4000 Monitor

003A

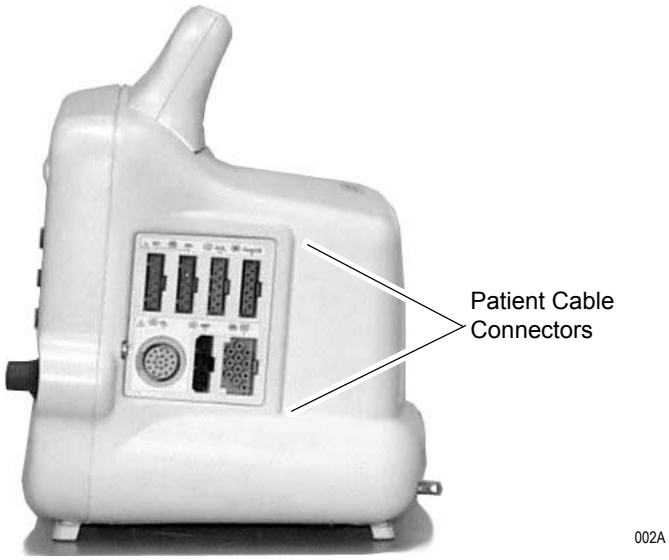
Dash 5000 Monitor

NOTE

For compatibility information, contact Technical Support.

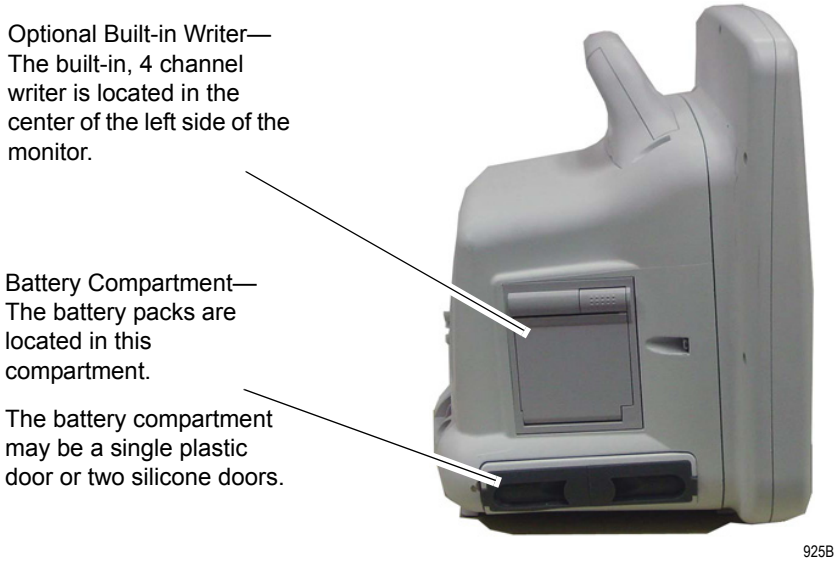
Right Side View

All of the patient cable connectors are located on the right side of the patient monitor. A **Trim Knob™** control provides single control operation of virtually all patient monitor functions.



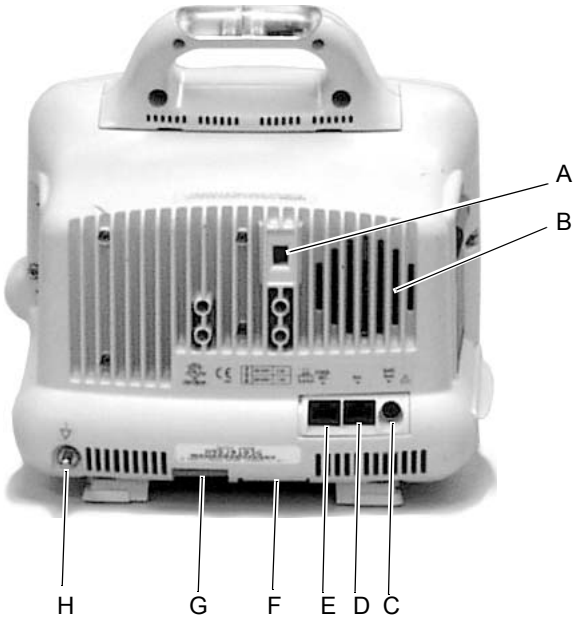
Left Side View

On the left of the patient monitor, you can find the built-in writer and the battery compartment.


Optional Built-in Writer—The built-in, 4 channel writer is located in the center of the left side of the monitor.
Battery Compartment—The battery packs are located in this compartment.
The battery compartment may be a single plastic door or two silicone doors.
925B

Back View

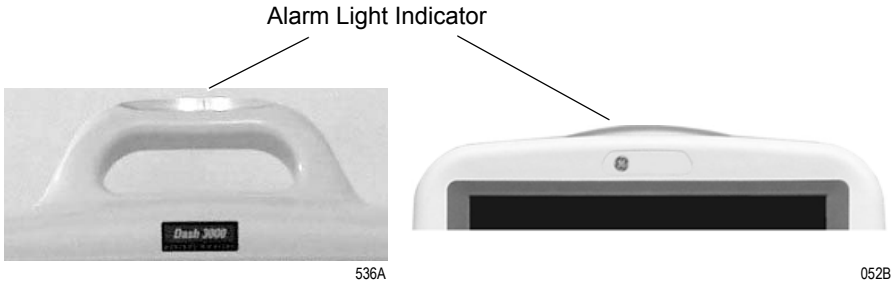
All ports for equipment and network are on the back of the patient monitor.



	Name	Description
A	line voltage selector	This selector is factory set to match the line voltage rating for your country.
B	audible alarm enunciator	The internal speaker provides sound for audible alarms. For better sound quality do not block speaker.
C	**Defib Sync** port	Provides ECG analog output signals to user-supplied equipment. A 5-volt, 2-millisecond artificial pacer spike is added to the analog output when PACE is on and detection occurs.
D	**Aux** port	Used for RAC 2A, BISx and other compatible auxiliary devices.
E	**Ethernet** port	Used to connect a monitor to the Unity Network for patient monitoring or for software installation.
F	peripheral expansion port	Used for connecting to a Dash Port™ docking station or other compatible auxiliary devices.
G	AC power	Used for connecting an AC power cable.
H	equipotential terminal	For measurements in or near the heart we recommend connecting the monitor to the potential equalization system. Use the green and yellow potential equalization cable and connect it to this pin.

Optional Alarm Light Indicator

An optional alarm light indicator may be built into the handle of the Dash 3000 patient monitor or into the display bezel of the Dash 4000/5000 patient monitor. When activated, the LED indicator flashes red for Crisis patient status alarms and yellow for Warning patient status and system alarms.



Dash 3000 Monitor **Dash 4000 and 5000 Monitors**

Controls and Indicators

The user interface consists of a flat panel display and the keypad assembly that includes a **Trim Knob** control, function keys, and LED indicators.

Flat Panel Display

The active-matrix color liquid crystal display (LCD) is assembled into a shock absorbing isolator that fits within the patient monitor's front bezel to protect the display from mechanical shock during use.

The acrylic optical filter protects the display panel from impact and enhances visibility with its non-glare surface coating on the viewing side of the filter. It also has a scratch-resistance surface coating.

Trim Knob Control

The **Trim Knob** control is a 24-position rotary control with a push selection switch.

Function/Power Keys

Dash 3000/4000 Patient Monitors

Power, **Print**, **NBP Go/Stop**, **Zero All**, **Silence Alarm/Admit**.

Dash 5000 Patient Monitor

Power, **Standby**, **Admit/Discharge**, **NBP Go/Stop**, **NBP Auto**, **Print**, **Silence Alarm**, **Zero All**, **Trend**, **Main Display**.

Power Key

The patient monitor is powered at all times when it is plugged into AC power. When the patient monitor is not plugged in to AC power, this key turns the patient monitor On and Off.

When AC power is present, this key toggles the operational mode of the patient monitor between normal operation and stand-by mode. In standby mode patient monitoring discontinues. Only the charging function continues and the charging status indicators operate as described below.

Indicators

While the patient monitor powers up or changes between normal mode and standby mode, all four front panel indicators illuminate.

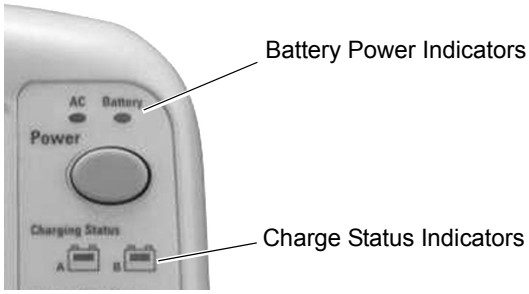
AC Power Indicator

The indicator lights green when AC mains power is applied to the patient monitor (including when the patient monitor is in the standby mode). The indicator does not illuminate when the patient monitor has no AC mains power.

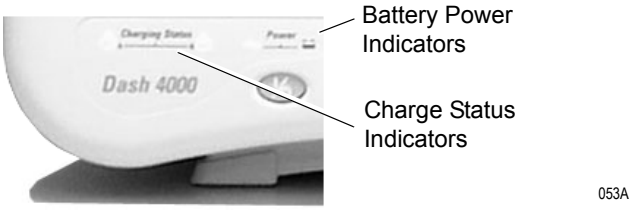
Battery Power Indicator

The indicator lights yellow when the patient monitor is operating on battery power. The indicator does not illuminate when the patient monitor has no battery power. Battery indicators are located on the front panel of the patient monitor. They indicate when battery power is used and the battery charging status.

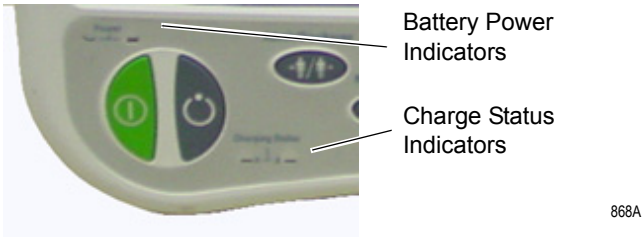
Dash 3000



Dash 4000



Dash 5000



Charging Status Indicators

An icon for each battery indicates its charging status. The battery icon lights yellow when the respective battery is being charged. If both batteries are present and require charging, then both icons illuminate even though they will be charged sequentially. The battery icon lights green when the respective battery is fully charged.

When the patient monitor is operating under battery power the battery icons are not illuminated. The icons are also not illuminated when the respective battery is either not being charged, not installed, or has failed.

The following table explains what the charging status indicators mean.

NOTE

No specific indicator distinguishes a failed battery pack condition from a condition where the battery is not installed or is not being charged. Go to the Service Menu for Battery Status. Refer to "Battery Alarms and Messages" on page 6-7 for further information.

LED Color	Explanation
Yellow	Two battery icons, labeled **Charging Status A** and **B**, illuminate yellow when the respective battery is being charged. If both batteries are present and require charging, then both icons illuminate yellow even though they charge sequentially.
Green	The icon lights green when the respective battery is fully charged.
No Light	The icon does not illuminate under the following conditions: ■ The respective battery is not installed. ■ The patient monitor is operating on battery power. ■ A failure condition has been detected for the respective battery.

Battery Status Indicators

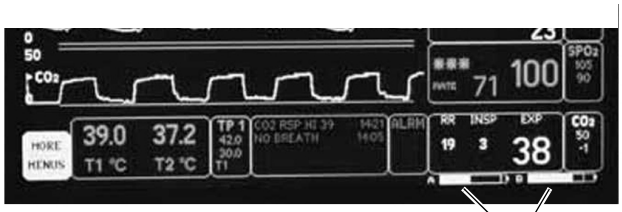
The battery status indicators are located inside the battery compartment. One green LED indicator is located above each of the two battery slots and lights green when the patient monitor is receiving power solely from the respective battery. The indicators do not illuminate when the patient monitor is not battery powered.

Neither indicator lights when the patient monitor is operating from both batteries simultaneously (i.e., in a very low battery charge condition when both batteries are joined together in order to sustain operation of the patient monitor).

Battery Capacity Gauge

On-screen capacity gauges indicate the battery's current state of health and charge status. A battery capacity gauge for each battery present displays below the parameter blocks in the lower right corner of the display. The capacity gauge indicates the remaining charge capacity (usable energy left) for each battery.

The capacity gauges fill in from left to right proportional to the battery charge level. The solid portion represents the full charge capacity of the battery as a percentage of its design capacity.



809A

Battery Capacity Gauges

Exchangeable/Compatible Battery Packs

WARNING

EXPLOSION OR FIRE - Using non-recommended batteries could result in injury/burns to patients and users. Only use batteries recommended or manufactured by GE. The warranty can be voided if non-recommended batteries are used.

Dash patient monitors running versions 5.4 or later only recognize and charge GE recommended batteries. Non-recommended batteries will run, but not charge, the Dash patient monitor. If battery is labeled GE Approved, the battery is compatible.

NOTE

Incompatible batteries display an “ERROR” message in the Battery Capacity Guage on the bottom right corner of the patien monitor screen.

Verify compatibility of an unmarked battery as follows.

1. Install a battery pack in the patient monitor.
2. Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
3. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407).
4. Select *BATTERY SERVICE.*
5. Verify that the *MANUFACTURER NAME* does not display *INCOMPAT*, *NME*, or *UNKNOWN* for the battery corresponding to *BATTERY A* or *BATTERY B* slot.

Optional Components

RAC 2A Module Housing

The RAC 2A module housing currently supports the SAM and ICG modules.

797B

An integral power supply is used to run the RAC 2A and support the needed voltages.

Dash Port 2 Docking Station

The docking station is a quick mount/dismount base for a Dash patient monitor. It gives the patient monitor easy connect/disconnect access to AC power, Unity Network™, a remote display, and auxiliary devices.

See the Dash Port 2 Docking Station Operating Instructions and the Dash Port 2 Docking Station Service Manual for additional information.

NOTE

When a Dash patient monitor is connected to the docking station, only the docking station's Ethernet port is active. The Dash patient monitor's network port remains inactive until the patient monitor is disconnected from the docking station.

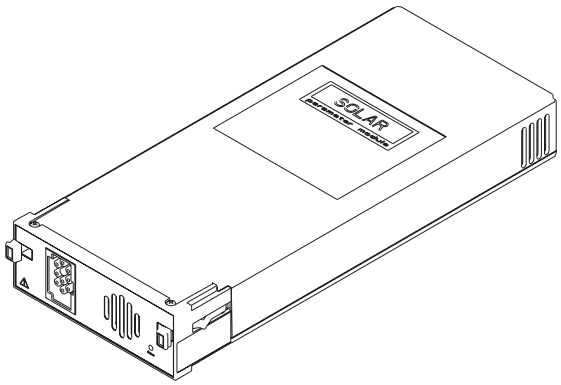
823B

An optional remote display can be connected to the system for viewing on a larger monitor, or in a separate room. The remote display requires:

- Dash Port 2 docking station,
- Dash 3000/4000 patient monitor software version 5 or later, or
- Dash patient monitor software version 6 with Dash Port 2 software version 2.0, and
- Must be within 150 feet of the Dash patient monitor.

ICG Module

The ICG module (impedance cardiography) measures and processes patient hemodynamic data.



825A

BISx

Available in software version 6 or later, BISx measures the effect of anesthetics and sedatives on the brain.

935A

Wireless Connection

The flexibility of the optional GE Unity Network is increased by using the wireless network. The wireless connection allows the user to roam from one access point to another, maintaining a strong seamless connection to the Unity Network. GE offers 802.11 and 802.11b wireless options.

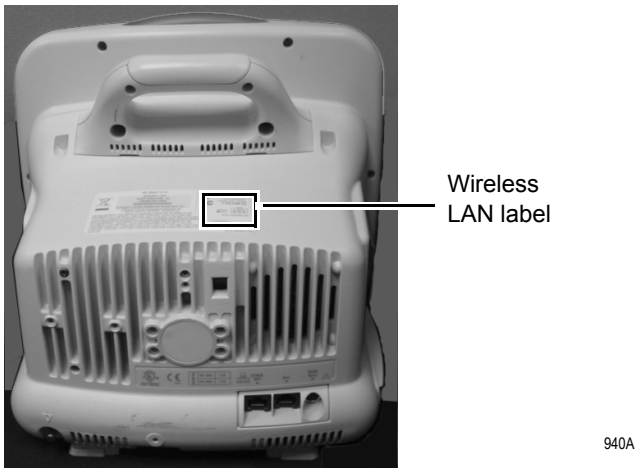
The patient monitor, with its optional built-in wireless card, functionally performs the same as a patient monitor connected directly to the optional Unity Network. It can be viewed at the central station and by other GE monitors on the network (i.e. Dash 3000/4000/5000, Eagle™ 4000, and Solar™ patient monitors). Patient monitors with a wireless connection can send and receive patient data via the access points to the Unity Network.

NOTE

It is recommended that wireless patient monitors that are moved from room to room have their patient monitor type configured as Rover or Rover/Combo monitoring.

To extend the Unity Network to a hospital's 802.11b wireless network, a proper installation and configuration needs to be performed. To maintain continuous wireless patient monitoring, refer to the Wireless LAN Configuration Guide and contact GE for consultation in integrating the Unity Network to a 802.11b wireless network.

To identify a patient monitor with the wireless option, look for the wireless LAN label.



Optional Remote Control

The optional remote control provides all patient monitor controls on a portable component with a **Trim Knob** control, and allows the user to operate the patient monitor from across the room. Eighteen hard keys are configured for adult, neonatal, or operating room applications.

821A

Software Packages and Software Options

Software Packages

The Dash patient monitor comes configured with the Basic software package. This package consists of standard-of-care parameters, lethal arrhythmia detection, dose calculations, and features required by clinicians caring for acutely ill patients.

Two additional software packages can be purchased separately or in any combination. These packages provide a variety of features that allow the patient monitor to be configured to best meet the needs of its intended environment.

The Cardiac software package focuses on cardiac conductivity. Its features include full arrhythmia analysis and storage, as well as ST segment trending, storage, and templates. The ability to adjust the ST measurement point is also included in this package.

The Cardiopulmonary software package centers on cardiac and pulmonary hemodynamics. Features include the PA insert and wedge algorithms, the intra-aortic balloon pump algorithm, and the thermodilution cardiac output algorithm, including predefined computation constants for the catheters of major manufacturers. Also included are cardiac and pulmonary calculations.

Software Options

Three software options can be purchased separately or in any combination with the software packages and software options.

The High Resolution CRG Trends option provides storage of up to 100 CRG events, and up to 24 hours of CRG trend data, in addition to the CRG feature set found in the Basic software package.

The 12SL™ ECG analysis program with Gender Specific Criteria and the Acute Cardiac Ischemia–Time Insensitive Predictive Instrument (ACI-TIPI) analysis option uses recorded ECG data to produce a numerical score which is the predicted probability of acute cardiac ischemia. In addition, the gender-specific criteria improves the detection of acute myocardial infarctions (AMI) in women.

The Unity Network option enables you to view other patients on the network, interface with a central station and other network devices, and perform Combo or Rover Combo monitoring.

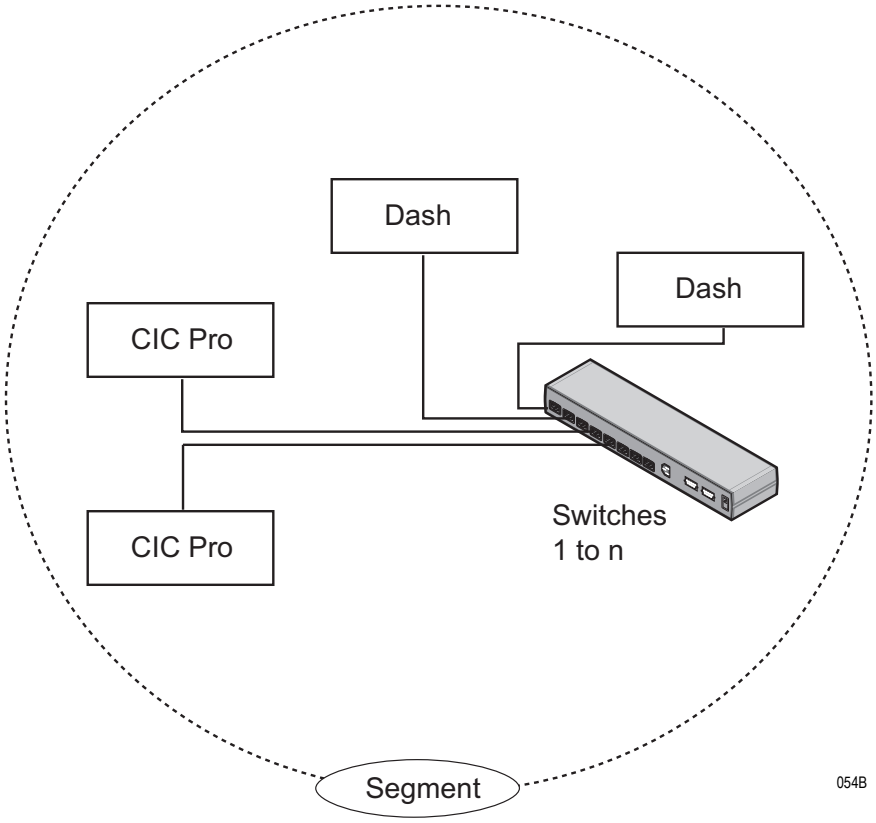
Ethernet Communication

About Ethernet

The GE Unity Network uses Ethernet for device to device communications. This local area network links all patient monitors, clinical information centers, and other GE equipment throughout the hospital. Depending on the construction of the hospital, thick-net, thin-net, or CAT-5 twisted pair cabling is used. The Dash patient monitor is designed to be used with twisted-pair cabling. Consult GE when trying to interface with either thick-net or thin-net cabling. The real-time GE Unity Network operates at 10 Mbps, half-duplex.

Twisted Pair

Twisted pair is the most popular cabling because it is easy to install and flexible to work with. It uses the star topology with a switch as the hub of the segment. A maximum of 100 meters or 328 feet is the longest length of twisted pair cable allowed. The maximum number of devices on the GE Unity Network is 1,000.



Network Terms

Node

Each network device or node is assigned a Media Access Control (MAC) Address number and requires a network connection to interface between the network device and the network.

Media Access Control (MAC) Address

A 48-bit address assigned by the manufacturer to uniquely identify a node of the network. This is also known as the Ethernet address.

Switch

To implement the star topology, each network device is connected to a network switch. The switch passes all network data between each network device in the star segment. Typically, the switch supports 12 to 48 network devices and may be linked to other switches to form larger networks.

Segment

A network segment is comprised of all devices connected to one or many switches which are in-turn connected together to form a larger network. The boundaries of the segment are defined by networking equipment that regulate the flow of packets into and out of the segment (e.g. routers and switches).

IP Address

A 32-bit (IPv4) address assigned by the user (either statically or dynamically from a server) to uniquely identify the packets from a device for routing purposes.

Subnet

A subnet is a logical segment of a larger network that shares a common IP address range as defined by a subnet mask. Proper subnetting can improve the performance and security of a network.

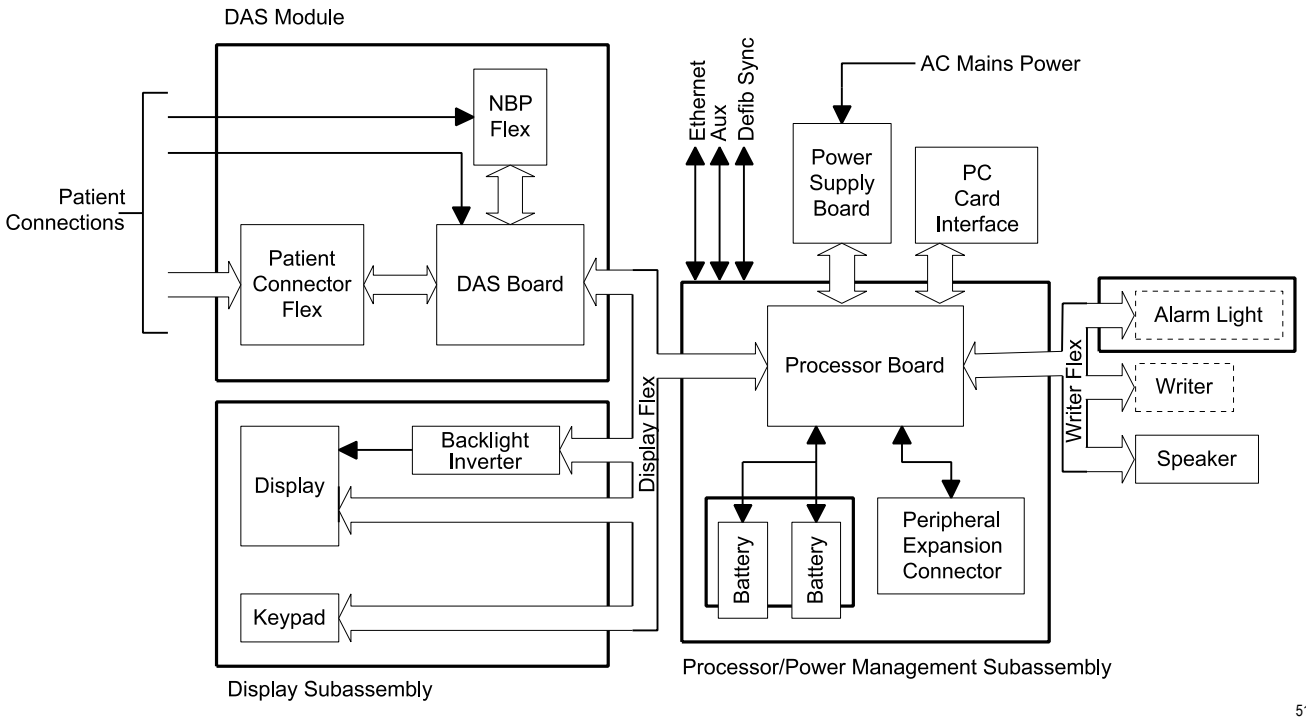
Theory Of Operation

Components

The patient monitor is housed in a single package. The main components of the assembly are:

- Power Supply
- Data Acquisition System
- Processor/Power Management subsystem (including battery case and expansion port)
- Speaker
- Handle subassembly (including the Alarm Light option)
- Thermal Printer (optional)
- Battery

Overall Patient Monitor Block Diagram



Power Supply

The subsystems within the patient monitor operate from a common 9 to 18 V power bus. Due to the wide variety of voltages required by the various subsystems, power is converted locally by each subsystem. This architecture results in an efficient and compact system by reducing the number of conversions required and optimizing the physical size of each converter for the specific application.

When operating on AC mains power, the power bus voltage is 18 V, generated by the offline switching power supply.

No AC mains power switch is provided.

The line voltage range switch must be set to select 115 V or 230 V (90 to 132 VAC or 190 to 264 VAC, respectively).

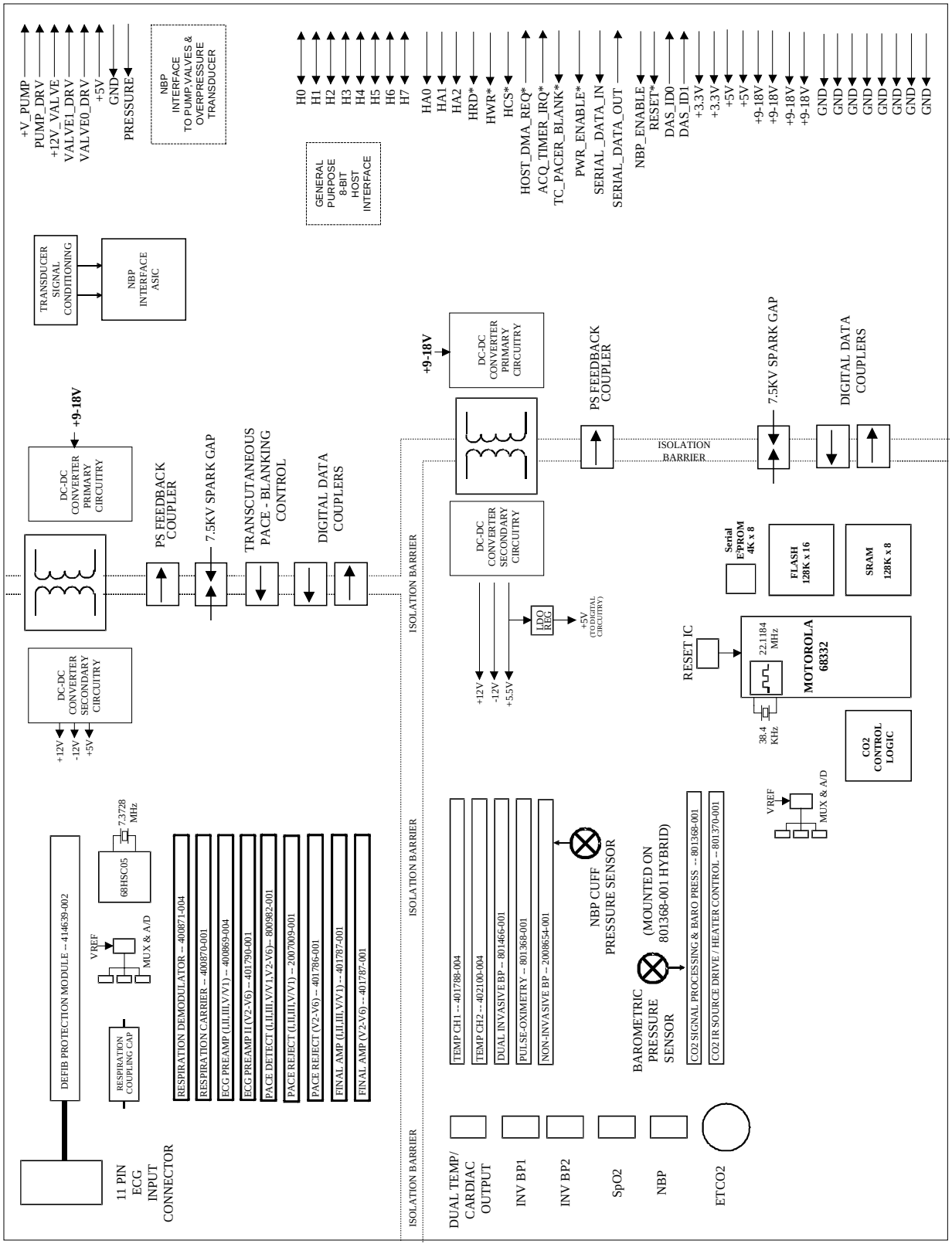
Data Acquisition System (DAS)

All interfaces to the patient occur through the DAS. The ECG function uses a direct connection to the patient; therefore it is separately isolated from the other functions (except respiration, which shares the ECG patient interface) to substantially reduce coupling of noise and leakage currents to/from other functions. All remaining DAS functions (i.e., pulse oximetry, NBP, invasive pressure, temperature, cardiac output, and CO_2) share a common isolation barrier.

NOTE

The patient monitor supports three SPO2 configurations, Generic Ohmeda SPO2, Masimo SET SPO2, and Nellcor OxiMax SPO2.

DAS Block Diagram with Generic Ohmeda SPO2



528B

The DAS block diagram with Generic Ohmeda SPO2 consists of the following three sections.

Section	Description
ECG/Respiration	Separately isolated section includes a 7.3728MHz 68HSC05 microcontroller, A/D conversion, signal processing hybrids and DC-DC isolation converter.
Main DAS	Separately isolated section includes a 22.1184MHz 68332 microcontroller with FLASH and SRAM memory, A/D conversion, signal processing hybrids and DC isolation converter.
Non-Isolated circuits	Includes serial and parallel host interfaces and NBP pump, valves, and over-pressure circuitry.

ECG

The ECG function detects heartbeats and arrhythmias, measures heart rate (HR) and ST segment deviation, and generates a 12SL diagnostic interpretation. Patient alarms with adjustable high and low limits for HR and ST segment deviation are provided. Additional patient alarms are provided for arrhythmias and PVCs. System alarms for individual lead failure and all leads failure are provided.

The patient monitor accepts the green 3, 5, and 10-leadwire Multi-link ECG connectors (compatible with Eagle 3000 monitor, Eagle 4000 monitor, and Tram modules).

Respiration

The respiration function measures respiration rate (RR) and detects apnea through the ECG leadwires using the impedance variation technique. Patient alarms for RR (with adjustable high and low limits) and apnea (with adjustable time limit) are provided. System alarms for lead failure, cardiac artifact, and learning are provided.

Generic Ohmeda Pulse Oximetry (SpO_2)

The pulse oximetry function measures arterial oxygen saturation (SpO_2) and peripheral pulse rate (PPR). Patient alarms with adjustable high and low limits for SpO_2 and PPR are provided. System alarms for probe off patient, low-quality signal, and pulse search are provided.

The patient monitor accepts the blue color-coded pulse oximetry connector (compatible with Eagle 3000 monitor, Eagle 4000 monitor, and the Tram *x*50-series modules). The patient monitor with Generic Ohmeda SPO2 supports Nellcor probes.

Non-Invasive Blood Pressure

The NBP function measures systolic pressure, diastolic pressure, mean pressure, and heart rate. Patient alarms with adjustable high and low limits for systolic, diastolic, and mean pressures are provided. System alarms for deflation failure, inflation failure, maximum pressure exceeded, measurement time exceeded, pulse too weak, hardware malfunction, and system pressure leak are provided.

The NBP function operates in manual, auto, and stat measurement modes. The patient monitor has backup protections for magnitude and duration of applied cuff pressure (with different settings in adult and neonatal modes).

The patient monitor accepts the rectangular NBP connector (compatible with the Eagle 3000 monitor and some versions of the Tram module).

Invasive Pressure

The invasive pressure function measures two blood pressures and calculates systolic pressure, diastolic pressure, mean pressure, and pulsatile pressure rate where applicable. Patient alarms with adjustable high and low limits for systolic pressure, diastolic pressure, mean pressure, and pulse rate are provided for each channel. System alarms for sensor status (failure and disconnected), Smart BP event (artifact), zeroing status (not zeroed, failure, and pressure sensed), and PA Wedge status (wait, inflate, processing, complete, and no pulse) are provided.

The user can set an adjustable low-pass filter to 12 or 40 Hz. The 12 Hz filter is implemented in software; the filter is disabled at the 40 Hz setting.

The patient monitor accepts the red color-coded invasive pressure connectors (compatible with the Eagle 3000 monitor, Eagle 4000 monitor, and Tram modules).

Temperature

The temperature function measures two temperatures. Patient alarms with adjustable high and low limits for temperature are provided. System alarms for sensor and calibration failures are provided.

The patient monitor accepts the brown color-coded connector (compatible with the Eagle 3000 monitor, Eagle 4000 monitor, and Tram modules). The patient monitor supports both YSI Series 400 and 700 thermistor probes. The probe type is determined by identification signals in the probe adapter cable.

The temperature connector and measurement circuits are shared with the cardiac output monitoring function; therefore you cannot use both functions concurrently. A signal in the patient cable indicates the appropriate function.

Cardiac Output

The cardiac output function measures blood temperature and injectate temperature, and uses the thermal dilution method to calculate cardiac output. Patient alarms with adjustable high and low limits for blood temperature are provided. System alarms for sensor failure and unstable blood temperature are provided.

The patient monitor accepts the brown color-coded connector (compatible with the Eagle 4000 monitor and Tram modules).

The cardiac output connector and measurement circuits are shared with the temperature monitoring function. You cannot use both functions concurrently. A signal in the patient cable indicates the appropriate function.

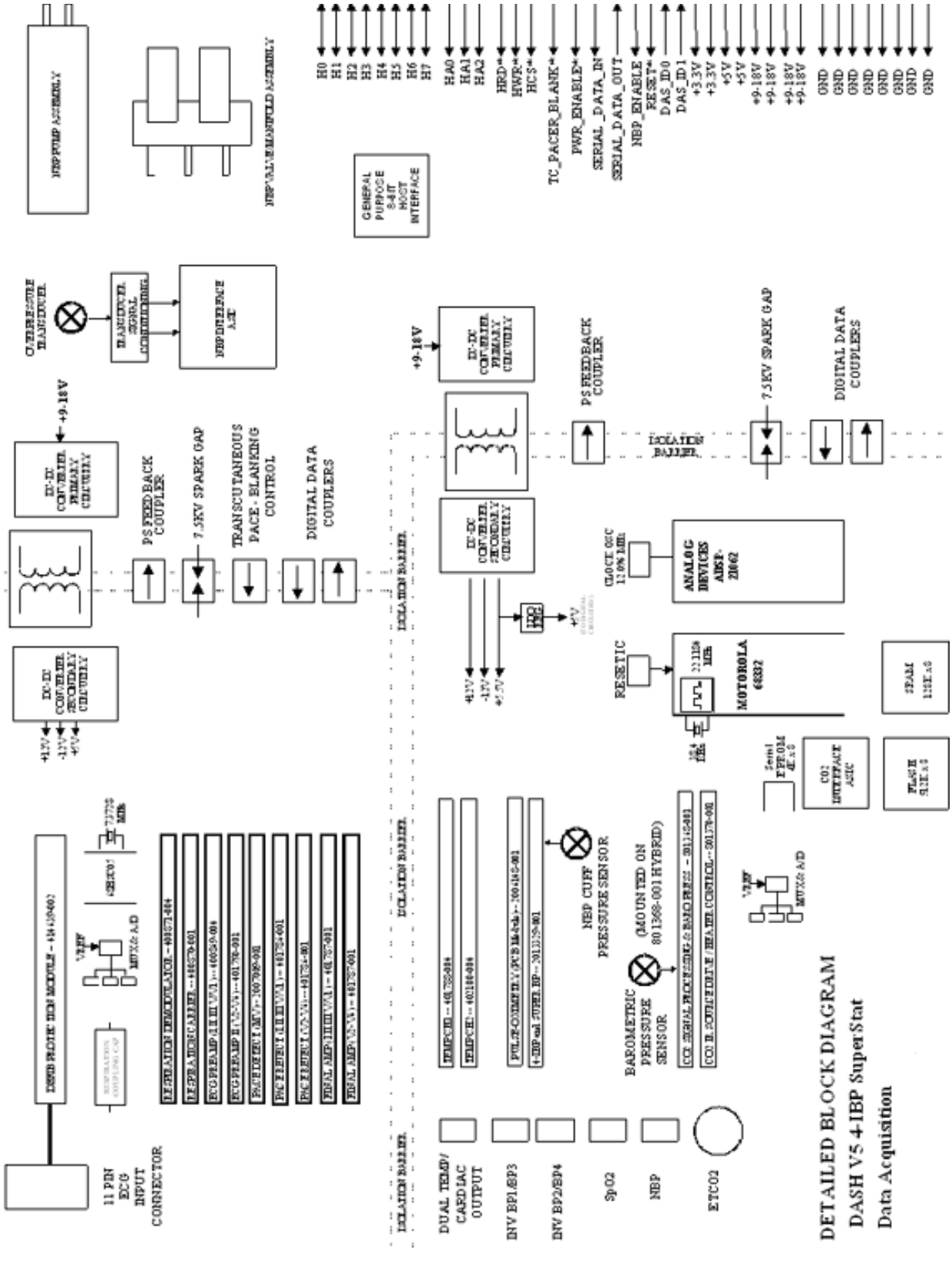
Carbon Dioxide (CO_2)

The CO_2 function measures inspired and expired CO_2 and respiration rate using the infrared light absorption technique. The patient monitor connects to an external CapnoFlex Low Flow Sidestream module or Novametrix Capnostat III sensor that clips to an airway adapter in the patient's ventilation circuit. The circuits to drive the sensor and process its incoming signal are located within the DAS.

Patient alarms with adjustable high and low limits for inspired CO_2, expired CO_2, and respiration rate are provided. An additional patient alarm for no breath detected is provided. System alarms for various sensor conditions are provided.

The patient monitor accepts the yellow color-coded connector.

DAS Block Diagram with Masimo SET SPO2



The DAS system block diagram with Masimo SET SPO2 and four SuperStat BP channels consists of the following three sections.

Section	Description
ECG/Respiration	Separately isolated section includes a 7.3728MHz Motorola MC68HSC705C8A microcontroller, A/D conversion, signal processing hybrids and DC-DC isolation converter.
Main DAS	Separately isolated section includes a 22.1184MHz Motorola MC68332 microcontroller with FLASH and SRAM memory, an Analog Devices ADSP-21062 32-bit floating point digital signal processor running at 12.096MHz, A/D conversion, signal processing hybrids/modules and DC-DC isolation converter.
Non-Isolated circuits	Includes ECG and Main DAS isolation power conversion circuitry, serial and parallel host interfaces and NBP pump, valves, and over-pressure circuitry.

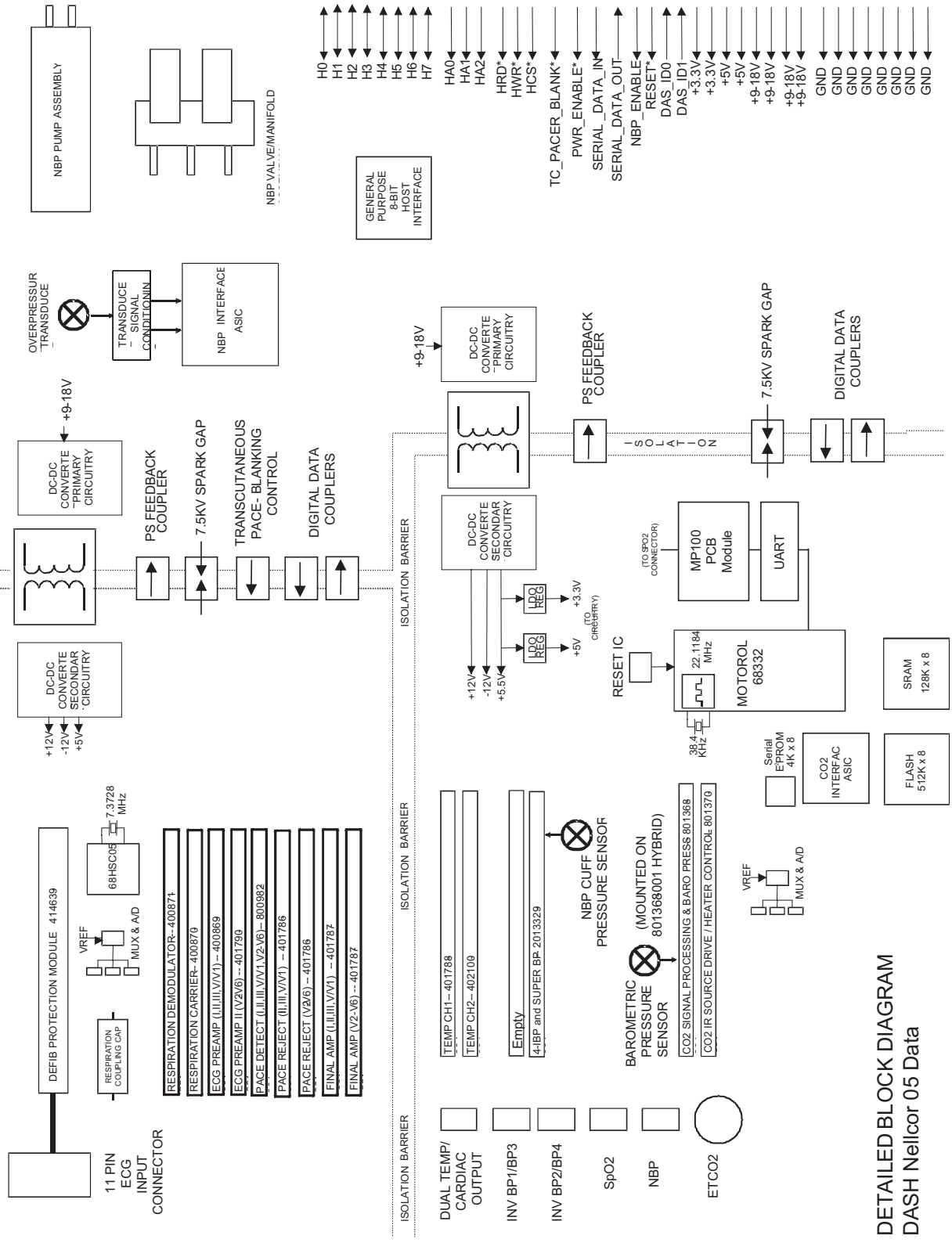
Parameter Functions of the DAS with Masimo SET SPO2, four BP Channels and Dinamap SuperSTAT NIBP

Except for the SPO2 parameter and additional 2 IBPs, the DAS with the Masimo SET SPO2 parameter supports the same parameters as DAS with the GE Ohmeda SPO2 parameter. Refer to 2-19.

Probes and Cable

The Masimo compatible DAS is intended for use exclusively with pulse-oximetry probes from Masimo Corporation. An adapter cable is used to interface the probes to the DAS front panel Nicolay connector. The Nicolay connector utilizes a key pattern unique to Masimo.

DAS Block Diagram with Nellcor 05 (OxiMax) SP02



The DAS block diagram with Nellcor 05 DAS PCB assembly consisting of three sections:

Section	Description
ECG/Respiration	Separately isolated section includes a 7.3728MHz 68HSC05 microcontroller, A/D conversion, signal processing hybrids and DC-DC isolation converter.
Main DAS	Separately isolated section includes a 22.1184MHz Motorola MC68332 microcontroller with FLASH and SRAM memory, an Analog Devices ADSP-21062 32-bit floating point digital signal processor running at 12.096MHz, A/D conversion, signal processing hybrids/modules and DC-DC isolation converter.
Non-Isolated circuits	Includes serial and parallel host interfaces and NBP pump, valves, and over-pressure circuitry.

The DAS design includes the Nellcor MP100 Module technology. Nellcor SPO2 is classified as motion-resistant. It uses advanced digital signal processing algorithms to extract very low-level SPO2 signals in the presence of artifact induced noise.

The DAS contains all circuitry necessary to support the MP100 Module. The Nellcor MP100 Module contains:

- All SPO2 front end circuitry, such as the digitally programmable photodetector signal conditioning, A/D conversion, digitally programmable back-to-back LED IR/RED emitter drive and on-board diagnostic / sensor identification signal processing circuits.
- A digital signal processor (DSP), clock circuitry, and program memory. The Nellcor SPO2 algorithms executes on the DSP. No external memory interface is provided. The DSP is "reset-able" by the DAS CPU.
- A UART for communication of commands and data.

Parameter Functions of the DAS with Nellcor OxiMax SPO2, four BP Channels and Dinamap SuperSTAT NIBP

Except for the SPO2 parameter and additional 2 IBPs, the DAS with the Nellcor OxiMax SPO2 parameter supports the same parameters as DAS with the GE Ohmeda SPO2 parameter. Refer to 2-19.

Probes and Cable

The DAS is intended for use only with Nellcor digital probes. It is not for use with non-Nellcor probes or with Nellcor R-cal (resistor id) probes. An adapter cable is used to interface the probes to the DAS front panel Nicolay connector.

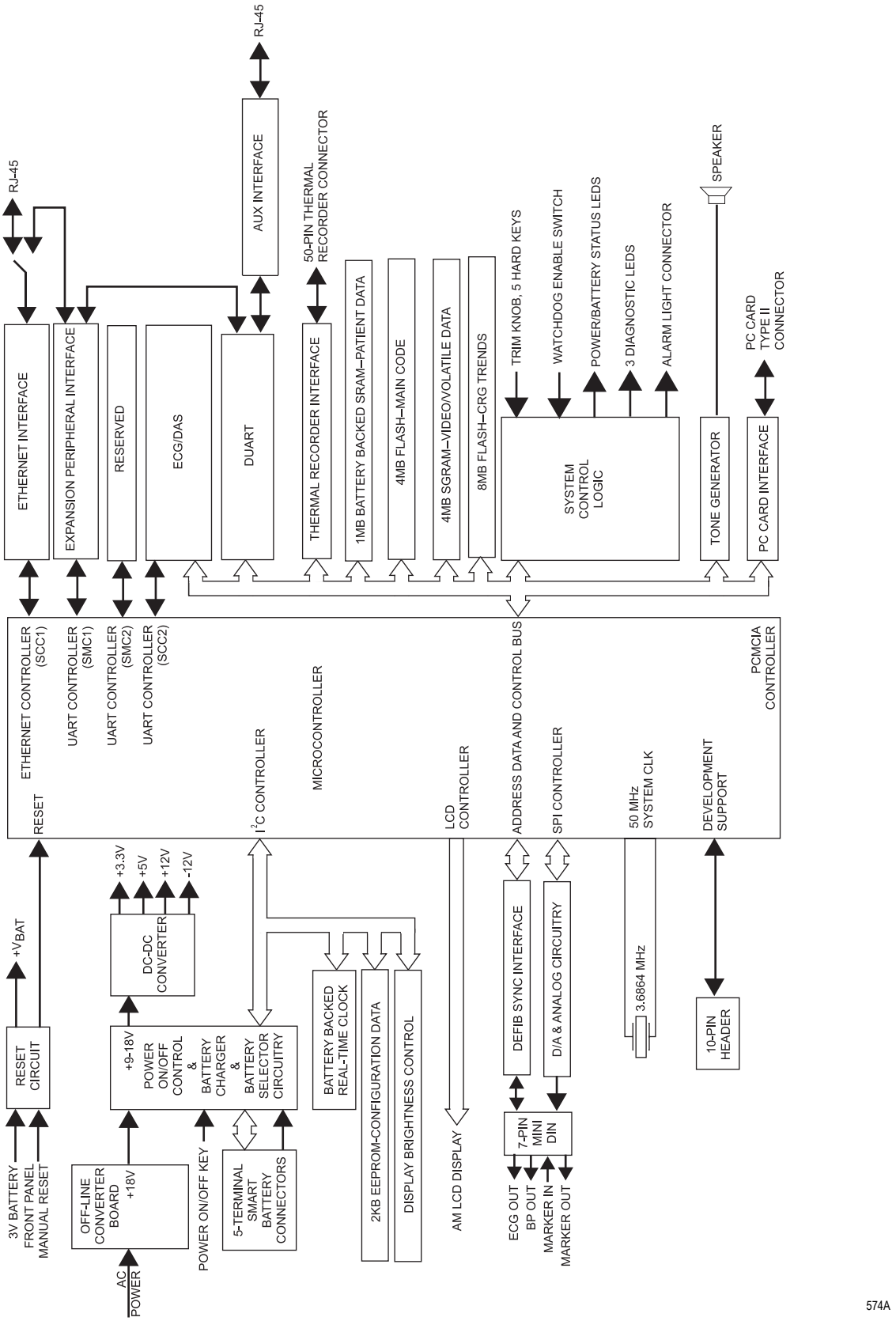
Processor/Power Management Subsystem

Overview

The main processor/power management PCB contains the electrical hardware to provide data processing and display of patient and monitor configuration data, communication and interface circuitry, and power conversion and battery management functions for the patient monitor.

The high level of integration attained in the design of the processor/ power management PCB is attributed to the use of several highly integrated devices. A complex communications controller, ASIC, and battery management hardware significantly improve the performance and reduce the complexity and cost of the assembly. In addition to the CPU, the main microcontroller contains a six-channel communications processor as well as memory, PC Card, and video controllers. The devices used in the core processing architecture all operate at 3.3 V to minimize power consumption, yet the main processor and ASIC are tolerant of 5 V hardware peripherals.

Block Diagram of Microprocessor and Power Management Subsystem



Main Microcontroller

The microcontroller contains two processors:

- a true internal and external 32-bit CPU core, and
- a communications processor module (CPM).

The CPM contains an 8 kilobyte dual port RAM to communicate with the CPU core, and once configured communicates with external devices with minimum CPU intervention. External logic is reduced by the internal memory controllers and a system interface unit which provides a clock synthesizer and timers used in this design. Writer communications is supported by direct memory access and processing performance is enhanced by 4-kilobyte instruction and data caches.

Microcontroller Feature	Patient Monitor Function
Serial Communications Controller 1	Unity Network
Serial Communications Controller 2	DAS communication
Serial Management Controller 1	Peripheral expansion communication
Serial Management Controller 2	Reserved
Interprocessor-Integrated Controller	Batteries, battery charger, Real-time clock, EEPROM, digital potentiometer for display brightness control
Serial Peripheral Interface	DAC for ECG and BP analog outputs; ASIC configuration
User Programmable Machine A	Memory controller for synchronous graphics RAM
User Programmable Machine B	Memory controller for synchronous flash
General-Purpose Chip-Select Machine	Memory and peripheral device control
LCD Controller	Color display
PC Card Controller	Future use
DMA	Writer communication
System Phase-Locked Loop (SPLL)	Generation of system clock from crystal oscillator

Microprocessor Supervisory Circuit, Microcontroller Internal Watchdog Timer

The microprocessor supervisory circuit provides reliable operation of the main processor board. This circuit monitors the +3.3 V power supply and asserts a 140 mS active low reset pulse when the power supply voltage is below +3.0 V during power-up and power-down conditions. A 3 V, 0.5 A hour lithium battery is used to preserve the contents of two SRAM devices and a real-time clock (RTC) when VCC is below the reset threshold.

System Control Logic

The system ASIC contains all of the system control logic for the processor/power management PCB. Such functions include address decoding, peripheral read and write control strobes, smart battery control logic, display control, multiple I/O ports, and front panel key switch debouncing.

Memory

Eight megabytes of non-volatile memory are provided to support the boot code and expansion memory such as high resolution graphic trends data storage. The boot block is write protected.

Eight megabytes of non-volatile memory are provided to support the main software application code.

Sixty-four megabytes of volatile memory are provided by the synchronous graphics RAM. This memory is used for stack, variable storage, dynamically allocated memory and video data storage.

One megabytes of battery-backed SRAM supports storage of 24 hours of 1-minute resolution patient trends, an error log containing 50 input errors, and 50 output errors and storage for the CPM buffers.

The patient monitor configuration data such as Internet and Ethernet addresses, unit name and bed number are maintained in the 2 kilobytes EEPROM. The serial device resides on the I^2C bus.

Real-Time Clock

The real-time clock incorporates an on-board quartz crystal. This feature simplifies the design and eliminates adjustments. The time of day on a standalone patient monitor is maintained to an accuracy of 15 seconds in 24 hours to support 24 hour trend data. The RTC device is one of the devices on the I^2C bus.

Audio Subsystem

Audio tones are generated using a tone generator, an audio amplifier, and an 8Ω, 2.5-in. speaker. The tone generator has built in D/A converters and a mixer to generate the dual frequency tones. Frequencies ranging from 150 Hz to 2800 Hz are produced.

Video Subsystem

The microprocessor contains a video controller that supports real-time and non-real-time waveform drawing, menu drawing, and parameter display.

Display brightness is controlled by a 50 kΩ digital potentiometer. The potentiometer is interfaced to the brightness control input of an inverter.

Analog Outputs

Two analog output channels support ECG and BP. The pace pulse is generated on the main processor board and inserted into the analog out ECG signal. The digital-to-analog conversion for both ECG and blood pressure output signals are performed on the main processing board via a two channel 12-bit serial DAC. Cal data is stored on the processor/ power management PCB.

Defib Sync

The QRS complex of ECG data acquired from the DAS generates the marker-out signal. A software selectable pulse width and pulse amplitude is provided in the Boot Loader Menu.

Optional Thermal Printer

The thermal printer includes complete control of the print head to print the desired waveforms and text as well as monitor power consumption. The host processor on the main processing board has direct communication via an 8-bit data bus to the processor residing within the thermal recorder.

The +9-18 V power supplied to the writer is heavily filtered to provide the storage capability to smooth power surges and transients caused by abnormal thermal printing. Such printing may occur if the patient monitor is subjected to ESU noise. In addition, a writer current limiting circuit restricts the current to the writer to 2.5 A. If this current limit is exceeded, the circuit faults and requires the current limiting circuit to reset through a microprocessor port.

Optional Alarm Light Indicator

An alarm light indicating two levels of visual alarms resides in the handle of the Dash 3000 patient monitor and in the display bezel of the Dash 4000/5000 patient monitors. Red and yellow alarm lights illuminate by addressing an ASIC output port. The Dash 3000 alarm light interfaces to the processor/power management PCB via the 40-pin writer interface. The Dash 4000/5000 alarm lights interface to the processor/power management PCB via the 100-pin DAS/Display / Keyboard interface.

PC Card

The main processor contains a PC Card controller, which complies with the PCMCIA standard. One 68-pin fully compliant Type II PC Card slot is supported in this design for wireless card.

Peripheral Expansion Interface

A 20-pin peripheral expansion interface is provided to support future use. An active low peripheral present signal may be polled by software to identify when a peripheral is attached to the patient monitor. Asynchronous, AUX, and a switched Ethernet serial communication channels are supported as well as switched +9-18 V and +5 V power.

DAS Communication

The microprocessor communicates with the DAS processor using the second serial communication controller (SCC) of the communication processor module (CPM). This asynchronous communication channel operates at TTL levels and is optically isolated within the DAS.

Optional Unity Network Communication

The microprocessor provides an Ethernet controller, which is implemented on SCC1 in order to benefit from the additional buffer descriptors compared to SCC2. Ethernet packets are stored in SRAM buffers and are transmitted and received by the 10BASE-T transceiver. The Ethernet clocks are generated from a 20 MHz crystal oscillator circuit and the transceiver. The transceiver also provides a visual indication in the form of four LEDS to identify packet transmit, receive, collision, and link integrity. The status of received data is indicated by the link integrity signal, which is used by the microprocessor to determine if the patient monitor is connected to the Unity Network.

An isolation transformer provides basic insulation to the twisted pair interface required to meet the ANSI/IEEE 802.3 standard (Ethernet). Isolation is required because during transport the power cord with the ground conductor is not available to provide a path for a fault condition. An 8-pin RJ-45 port containing two isolated, differential pairs is provided to connect the patient monitor to a network hub.

NOTE

Power is not provided in the twisted pair interface as in the attachment user interface (AUI) of other monitoring products.

Ethernet Priority

Ethernet communications are prioritized in the following order.

1. Top priority is the Peripheral Expansion interface.
2. Next priority is the Hardwired Ethernet connection at the back of the patient monitor.
3. Lowest priority is the optional wireless connection.

If none of the above exist, then the patient monitor is a stand-alone monitor.

Async Communication

Asynchronous communication ports comply with the GEMMS AutoPort protocol and are provided through an 8-pin RJ-45 port and the 20-pin peripheral interface described in the next section.

Debug Patient Monitor and Diagnostic LEDs

An integrated debugger operating in the debug mode within the main processor provides basic emulator-like features such as modification of register and memory locations and setting of breakpoints. The connector required for this serial communication is a dual row 10-pin header. This connector is located within the patient monitor and is not intended for field service use. Tracing of instructions and logic analysis is provided by an adapter board that connects to a socket installed on the main processor board instead of the microprocessor.

Three diagnostic LEDs located along the front edge of the board are provided for general purpose use and are under software control. The LEDs interface directly to port A of the microprocessor. A flashing green LED indicates normal monitoring operation.

Main DC-DC Converter Section

The main DC-DC converter consists of two independent synchronous rectifier buck regulators with one common controller.

The patient monitor uses a “point of use” power conversion architecture with +9-18 V being the main power distribution bus.

Four voltage outputs are developed on the processor/power management PCB:

- +3.3 V,
- +5 V,
- +12 V, and
- –12 V.

Each one of the four outputs are individually current limit protected against overload and short circuit.

Battery Subsystem

Battery charging and control is accomplished on the processor/power management PCB.

The battery is a smart battery and features an on-pack fuel gauge.

Lithium-Ion Battery Power

The patient monitor is designed to operate on battery power during transport or whenever AC power is interrupted. A complete battery management system allows you to obtain maximum battery performance. Audible and visual alarms alert you when loss of power is imminent and on-screen capacity gauges indicate battery charge condition and capacity.

Depending on usage, you can get up to 2.5 hours of run time per battery for new, fully-charged batteries. Monitoring NBP, CO2 and SpO2 drain battery power faster than other parameters. The display technology and brightness, graphing, and connection to a wireless network can also alter battery run times.

NOTE

A *BATTERY LOW* message at the top of the screen warns you prior to complete loss of battery power. Replace the battery or connect the patient monitor to an AC power source when the message displays.

The Lithium-Ion battery is a rechargeable battery containing Lithium-Ion cells. Each battery contains an integrated electronic fuel gauge and a safety protection circuit.

Impact of Lithium-Ion Battery Technology on the Battery

The following are key points to know about Lithium-Ion battery technology:

- The battery self-discharges on its own, even when it is not installed in a patient monitor. This discharge is the result of the Lithium-Ion cells and the bias current required for the integrated electronics.
- The battery self-discharges. The self-discharge rate doubles for every 10°C (18°F) rise in temperature.
- The capacity loss of the battery degrades significantly at higher temperatures.
- As the battery ages, the full-charge capacity of the battery degrades and will permanently be lost. As a result, the amount of charge that is stored and available for use is reduced.

How to Improve Battery Performance

Installation Guideline

Position the patient monitor in a location that does not artificially increase the operating temperature of the battery.

- To optimize battery life and performance, choose a location that does NOT artificially increase the ambient temperature surrounding the patient monitor.
  - Do not place the patient monitor near a heat vent or near heat-generating equipment, such as computer monitors.
- Avoid placing the patient monitor in corners where the airflow may be restricted.

Charging Guideline

Use the Cadex SMart Two+ charger to charge the battery instead of charging the battery inside the patient monitor.

- The Cadex SMart Two+ charger maintains a lower battery cell temperature during the charge cycle than the patient monitor. This reduction in temperature will extend the life of the battery.
- The Cadex SMart Two+ charger charges one battery in less than 4 hours and two batteries in less than 8 hours. When two batteries are used, the charger applies half of the charging current to each battery.

Conditioning Guideline

Remove the battery from the patient monitor every six months and condition it using the Cadex SMart Two+ charger. This condition cycle recalibrates the electronic fuel gauge.

Storage Guidelines

Do not purchase more batteries than you will use in one year. The battery does not have an indefinite shelf-life. See "How to Store the Battery" on page 5-8.

How to Identify Battery Charge Capacity

Battery Capacity Definitions

The following terms are used to define the capacity of the battery:

- Design Capacity — The theoretical capacity of the battery cells when the battery is new.
- Full Charge Capacity — The actual amount of charge the battery can store and deliver to the patient monitor.
- Remaining Charge Capacity — The amount of Full Charge Capacity currently remaining in the battery. This is a percent of Full Charge Capacity.

Identify Battery Charge Capacity Using the Patient Monitor

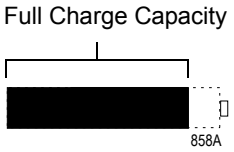
One new, fully charged battery lasts about 2.5 hours. Two new, fully charged batteries last about 5 hours.

A battery that has 100% Design Capacity and is charged to 100% of this capacity lasts approximately 2.5 hours. However, as the Full Charge Capacity declines, the approximate run time of a fully charged battery will decrease.

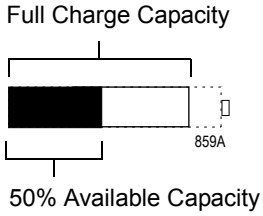
Single Battery Run Time: Approximately 2.5 Hours – An icon fully outlined with solid lines and completely filled indicates a new battery, fully charged to its Design Capacity.

Design Capacity and Full Charge Capacity

Single Battery Run Time: Approximately 2.0 Hours – The dotted portion of the icon outline shows that the battery has lost 20% of its Design Capacity. The solid-outline portion is filled in, showing that the battery is charged to 100% Full Charge Capacity.



Single Battery Run Time: Approximately 1.0 Hours – The dotted portion of the icon outline shows that the battery has lost 20% of its Design Capacity. The solid-outline portion is half filled in, showing that the battery is charged to only 50% of available capacity.



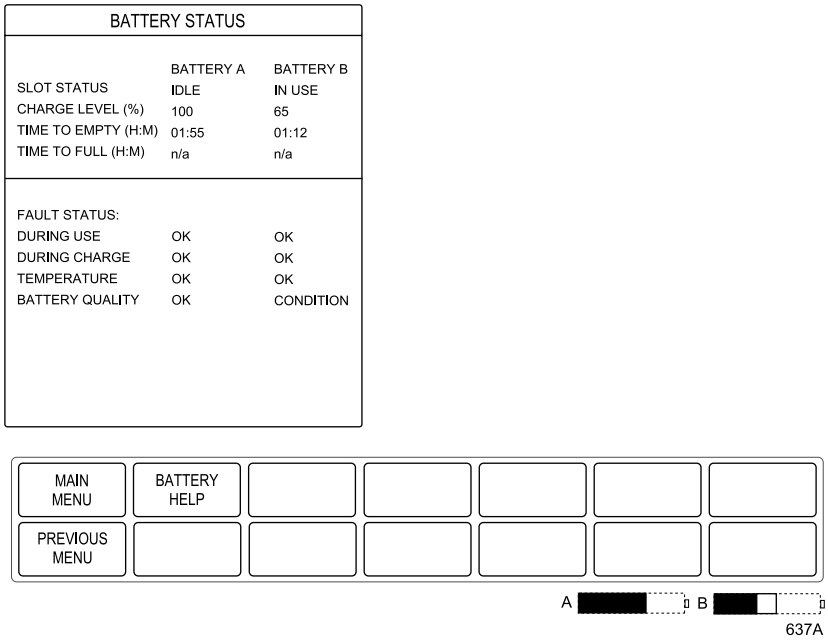
Identify Battery Capacity Using the Cadex SMart Two+ Charger

When you select the **Target Capacity** switch on the charger, the charger compares the battery's performance to a 60%, 70%, or 80% target capacity set on the battery charger. If the battery fails to meet the target performance, the battery charger will prompt you to condition the battery. If after the condition cycle has been completed, the battery does NOT meet the target performance, then the battery charger will illuminate a "fail" light.

Identify Battery Status Using the Battery Status Menu

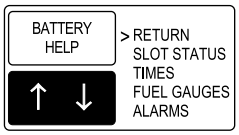
This menu option opens a menu and information window that provides current battery status information.

1. Select *MORE MENUS* from the Main Menu.
2. Select *BATTERY STATUS* to display the Battery Status Menu and information window.



- If a battery is not present, *NO BATT* displays in the *SLOT STATUS* column.
- If communication with the battery has failed, *NO COMM* displays in the *SLOT STATUS* row and *UNKNOWN* displays in all other rows.
- If a battery is incompatible, *INCOMPAT* displays in the *SLOT STATUS* column and *UNKNOWN* displays in all other fields.

Battery Help Menu



Each menu option opens an information window that includes the following information:

- *RETURN* — Returns to the Battery Status menu.
- *SLOT STATUS* — Provides definitions of the battery conditions.
  - *NO BATT* — No battery is installed in this slot.
  - *INIT...* — Battery is just installed, establishing communication.
  - *NO COMM* — Communication with this battery has failed because it is either sleeping, defective, or not a SMart Battery.
  - *INCOMPAT* — The battery is not compatible with this patient monitor's battery management system.
  - *FAIL* — See message displayed in the lower half of the display.
  - *IN USE* — This battery is currently powering the patient monitor.
  - *FULL* — Fully charged.
  - *CHARGING* — Currently being charged.
  - *IDLE* — Not currently in use or charging.

- *TIMES* — Defines "time to empty" and "time to full."
  - *TIME TO EMPTY:* — The time to empty represents an estimate of how much longer the patient monitor will be able to run with the current monitored parameters. Changing the setup, running NBPs, printing graphs, etc. will likely change the value of the time remaining. This value is only displayed when the patient monitor is powered by battery.
  - *TIME TO FULL:* — The time to full represents an estimate of the time remaining before this battery is fully charged. Total recharge time for this unit is the sum of both batteries' time to full.

- *FUEL GAUGES* — Explains the battery capacity gauges.

  The fuel gauge is filled from the left to right proportional with the battery's charge level. The full rated capacity of a new battery of this type is represented by a dashed outline. The maximum charge level for the battery currently installed is represented by a solid outline. As a battery ages, its maximum charge level becomes a smaller percentage of its Design Capacity. The solid portion represents the current charge level of the battery as a percentage of its maximum Full Charge Capacity.

- *ALARMS* — Explains low battery and battery fault alarms and messages.
  - *FAULT STATUS MESSAGES:* — General, charging, and temperature failures indicate that the battery has failed, or the charging of the battery has failed. Replace it with a different battery.
  - *CONDITION:* — Condition this battery using an external battery charger.
  - *LOW BATTERY ALARMS:* — The patient monitor will issue a System Warning alarm when there is approximately 10 minutes per battery run time remaining. The patient monitor will issue a System Warning alarm when shutdown is imminent (less than one minute left of remaining run time).

Speaker

The speaker is used for audible notification of alarms.

Handle Subassembly

The handle serves multiple purposes in the patient monitor. The modular design enables the user to add adapters for specialized applications.

The Dash 3000 handle houses the optional alarm light. This light is visible for 360° surrounding the patient monitor. The light is intended for applications when the audible notification is not useful or effective, such as noisy environments (e.g., emergency vehicles) or quiet environments (e.g., neonatal care areas). The alarm light indicates two levels of visual alarms:

- Crisis alarms (red LED) and
- Warning alarms (amber LED).

The handle also houses the wireless card antennas required for the optional wireless card subsystem.

Interfaces

Ethernet

The Ethernet RJ-45 port provides a hardware connection to the optional Unity Network. The patient monitor has a built-in transceiver for twisted-pair wire. Basic insulation (1500 VAC) isolates the patient monitor from networked devices.

AUX

The AUX RJ-45 port provides an asynchronous communication connection to devices within the bedside care area. Basic insulation (1500 VAC) isolates the patient monitor from other devices.

Defib Sync

The Defib Sync port provides signals needed to perform synchronized cardioversion with a defibrillator. The Marker Out signal is a pulse with selectable amplitude and width that coincides with the patient's ECG R-wave. The Marker In signal is returned to the patient monitor by the defibrillator. The Marker In signal causes the patient monitor to insert a defib marker in the displayed ECG waveform.

This port also provides two analog signals: ECG and invasive pressure. The patient monitor provides the top displayed ECG signal with reconstructed pace pulses. You can use this signal to trigger a defibrillator or intra-aortic balloon pump. BP1 produces the pressure signal and is intended for triggering an intra-aortic balloon pump.

Peripheral Expansion

Asynchronous communication, Ethernet (shared with the Ethernet RJ-45 port), 9-18 V power, 5 V power, and discrete I/O signals are provided in the peripheral expansion interface ports. The expansion port pairs with the AC mains power inlet to supply power to the patient monitor through a peripheral device.

Wireless LAN

Initialization

Initialization begins on a card insertion function call from card services. The card insertion function checks the manufacturer and card ID.

Initialization includes:

- Access Configuration Register - Set through card services to the manufacturer's recommended value.
- The MAC Address is set to the Dash's MAC address to provide seamless transition from hardwire to wireless and back.
- SSID - Set to stored value. This ID must be the same between a card and an access point for them to associate.

Reception

The read task waits on a receive interrupt from the card. When awakened, the packet length is validated and the packet is copied into an ethernet buffer. A transfer function using byte-sized transfers is used to ensure the access time to the card is minimized. The packet length and pointer is returned to the ethernet stream.

Transmission

The write task waits on a transmission packet to be queued. When awakened, the card is checked for association to an access point and for an available transmit buffer. Transmits are discarded if both are not true. The packet is copied into the card and a transmit command is issued to the card. The transmit task waits on a transmit complete interrupt from the card. This ensures a transmit buffer will be ready for the write.

Error Handling

The card does not support partial packets or other receive errors. On a transmit error the buffer will not be resent. Other events like buffer and queue overflows are reported through the error log system.

Association Status

Each association change is reported through the error log system.

Command Queue

Commands are queued if the Wait On Command (WOC) bit indicates the card has not completed the previous command. Commands that must complete are issued through a function call that ensures the command is completed before returning. This function delays between each check of the card to allow other tasks to run and must not be called with interrupts off or from within an interrupt.

Card enable/disable

The patient monitor network task determines which active network media should be used for ethernet communication. The peripheral connector has the highest priority followed by the rear connector then wireless. Interrupts to the wireless card are disabled until an enable wireless call is made by the patient monitor network task. Disabling the card simply turns these interrupts back off. Card events like association changes and receive overflows may be logged when interrupts are enabled, but this provides faster switch over between hardwire and wireless than resetting the card and re-initializing it on an enable.

Storage and Backup

Program Code Storage

Executable program code for the main processor, DAS processor, and thermal printer are stored in non-volatile programmable memory. To display the revision of the currently stored code, access the submenu of the main application's Monitor Setup menu.

Patient Monitor Settings

The processor/power management PCB stores default patient monitor settings in non-volatile memory. The user must restore the original settings if replacing the board.

Patient Data Storage

Static RAM backed up by a lithium battery soldered onto the processor/ power management PCB stores patient data.

Time and Date

A patient monitor on the network maintains time and date for at least five years. Time is accurate to within one second in ten hours. The clock is synchronized with a time master on the optional Unity Network.

Calibration Data

Calibration factors for NBP and CO_2 are stored in non-volatile memory on the DAS board.

Calibration factors for the analog output signals are stored in non-volatile memory on the processor/power management PCB.

Error Log

Input and output errors are retained in static RAM backed up by a lithium battery soldered onto the processor/power management PCB. Contents are retained for at least five years, provided that you exercise caution when you handle the board to prevent inadvertently discharging the battery (e.g. when you ship the board for problem diagnosis).

Optional Thermal Printer

The patient monitor uses the same 50-mm thermal printer module that is used in the PRN 50 stand-alone printer. It prints up to four waveforms at chart speeds ranging from 0.1 to 50 mm/s. The printer software is loaded independently from the patient monitor's software.

In the patient monitor, the printer module limits its current consumption to stay within its allocated system power budget.

3 Installation

Installation Overview

The following illustrates the installation steps for patient-ready monitoring.

Unpack equipment and inventory contents.

Go to "Checkout" on page 8-1 and perform all recommended inspection and safety procedures.

Insert two batteries into the battery compartment slots. (Charge batteries for 4 hours before using device on patients.)

Connect peripheral equipment and network, if applicable.

Connect power cord to Dash patient monitor, then plug into AC power outlet.

Power up the Dash monitor.

Go to "Configuration" on page 4-1 to configure for stand-alone or networked monitoring.

Connect patient cables per the Operator's Manual.

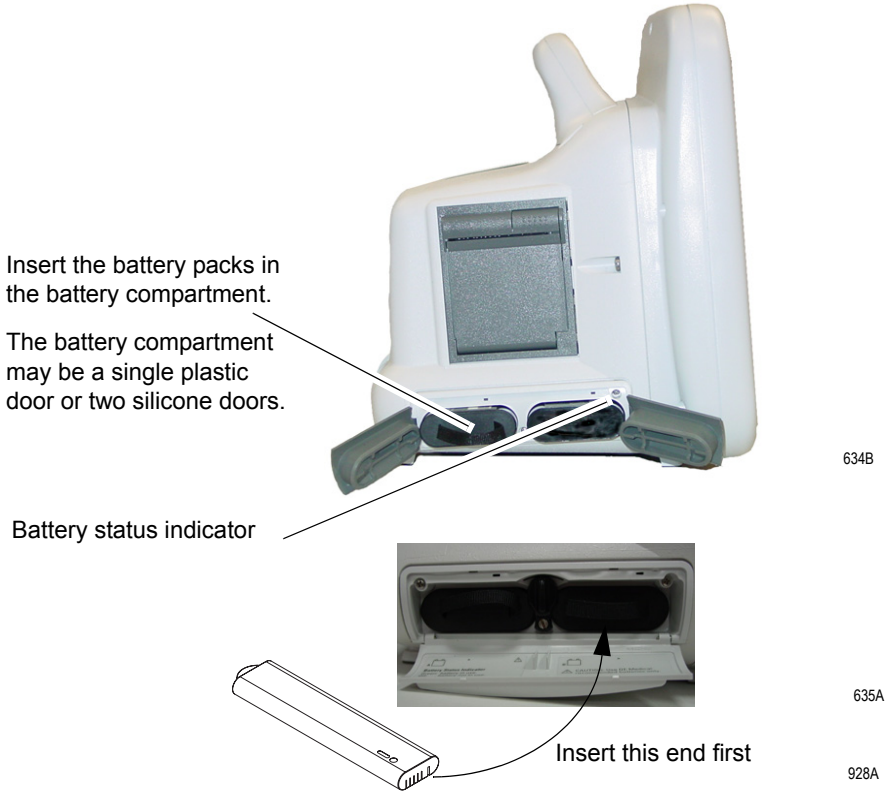
Before You Begin...

The following installation information assumes that the equipment has been unpacked and all procedures in "Checkout" on page 8-1 have been completed. If intending to use the Dash patient monitor under battery power, consider charging the batteries in a charger during the checkout procedures. Otherwise, insert batteries in the battery compartment as shown.

CAUTION
Leaks from battery cells can occur under extreme conditions. The liquid is caustic to eyes and skin. If the liquid comes into contact with eyes or skin, flush with clean water and seek medical attention.

The battery compartment is located on the lower left side of the patient monitor. Depending on your model, the battery doors may be one of the two variations shown below. Battery indicators let you know when the patient monitor is using battery power.

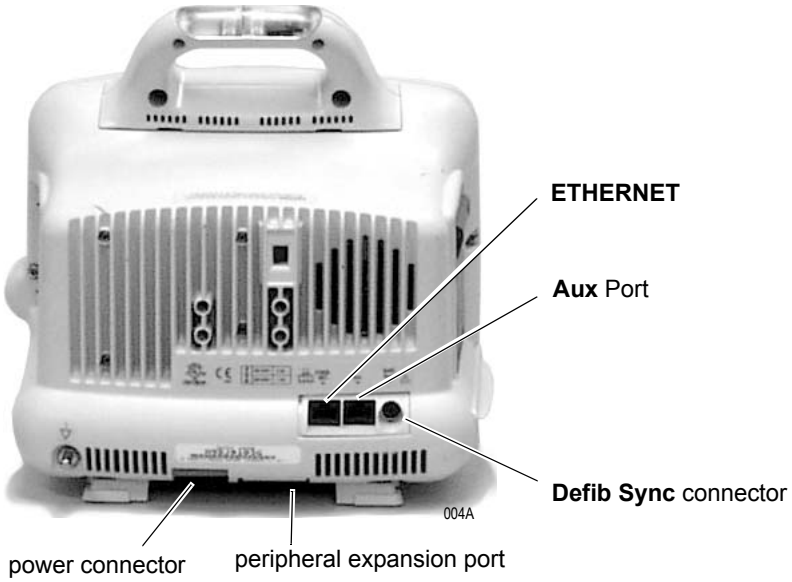
WARNING
Make sure the batteries are completely inserted and that the battery door is securely latched. Falling batteries could seriously or fatally injure a neonatal patient.


Insert the battery packs in the battery compartment.
The battery compartment may be a single plastic door or two silicone doors.
Battery status indicator
634B
635A
Insert this end first
928A

Connections

Back Panel Connections

The back of the patient monitor has all ports for equipment and network connections.



ETHERNET

The **ETHERNET** port provides an ANSI/IEEE 802.3 10BaseT Ethernet standard interface to the Unity Network.

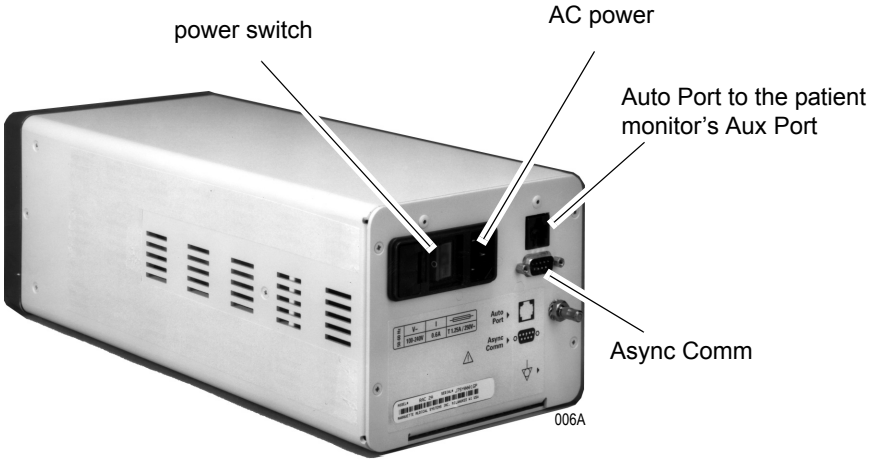
RAC 2A Housing Connectors

The RAC 2A module housing connects to the patient monitor via a standard category 5 patch cable (PN 418335-002) that plugs into the **Aux** port on the patient monitor and to the Auto Port on the back of the RAC 2A module housing.

BISx Module

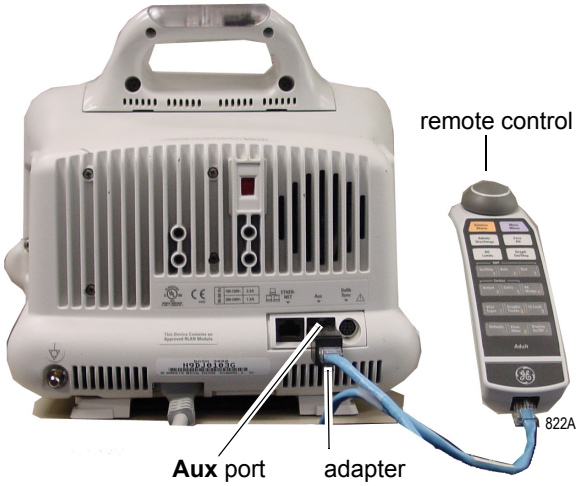
The BISx module connects to the patient monitor via a RJ-45 cable that plugs into the **Aux** port on the patient monitor and a Y-cable. One end of the Y-cable plugs into a power supply and the other end plugs into the BISx module cable.

The RAC 2A module housing does not have an Analog Output connector.



Remote Control

The remote control connects to the patient monitor via a communications cable which plugs into an Autoport to M-port adapter before it is inserted into the **Aux** port on the Dash patient monitor or the Dash Port docking station.



The remote control is programmed for specific care areas (adult, neonatal, or operating room).

NOTE

The error message *WARNING: REMOTE MISMATCHED WITH MONITORING MODE* displays if a mismatched remote control is connected to the patient monitor.

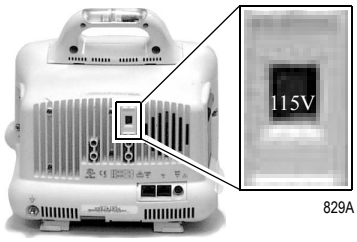
Defib Sync

The connector provides ECG analog output signals to user-supplied equipment.

CAUTION
Equipment damage. Connect all peripheral equipment before plugging the power cord into an AC outlet. Otherwise, connectors may be damaged.

AC Power

Use this connector to apply power to the patient monitor. The patient monitor will be powered at all times when using AC power (there is no AC power switch). The patient monitor is preset at the factory for a specific line voltage. Before applying power, verify the patient monitor's line voltage setting matches your power supply. If required, use a small bladed screw driver to change the line voltage setting. Refer to the label on the back of the unit for the voltage and current requirements.



line voltage selector:
115V for a 100-120V power source
230V for a 220-240V power source

Power Up

After making all connections, plug the power cord into an AC wall outlet.

When all cables are properly connected, press the **Power** button to turn the patient monitor on. All front panel indicators will illuminate until the power-up sequence is complete. After approximately 20 seconds you should see a display on the screen.

Configure

Go to "Configuration" on page 4-1 to configure and set up the Dash patient monitor for patient use.

4 Configuration

Before You Begin...

To configure a new patient monitor, you must first:

- know that the new patient monitor's software revision is compatible with the other patient monitors connected to the Unity Network.
- write down the exact care unit name from the central station.
- write down the bed name for the new patient monitor.
- know if the patient monitor will be used for either stationary or ambulatory (telemetry) monitoring or both.
- know if the patient monitor will be connected to a wireless network.
- know if the patient monitor will be moved from one internet connection to another.

This section explains how to configure a patient monitor in both types of patient monitoring system configurations:

- Stand-alone patient monitor — the monitor is not interconnected to other patient monitoring system devices, and
- Networked patient monitor — the monitor is interconnected to other patient monitoring system devices over the Unity Network for the sake of sharing patient data. The patient monitor communicates with central stations, printers, and other related equipment. This network is essentially an internet implementation.

  NOTE

  The Unity Network is a purchased option.

Service Menus

There are two distinct service menus for the patient monitor. The Boot Loader Service Menu is found in the Boot Code and is used for configuring the patient monitor or when downloading the Boot Code and main processor code. The Service Mode menu is located from the Main Menu and is used for various functions like monitor settings, calibration, graph tests, and downloading patient monitor interface software.

WARNING
The Boot Loader Service Menu and the Service Mode menus are intended for qualified personnel only. Do not 'experiment' with any commands found in the service menus. Experimenting with service commands can lead to lost patient data, damaged operating system software for the patient monitor, and even affect the Unity Network.

Boot Loader Service Menu

Activate the Boot Loader program as follows:

1. Hold down **NBP Go/Stop** (or **NBP Auto** on Dash 5000) and **ZERO ALL** (**FUNCTION**) on the front panel.
2. Press and release the **Trim Knob** control.
3. Keep holding **NBP Go/Stop** (or **NBP Auto**) and **ZERO ALL** (**FUNCTION**) until the Boot Loader information appears on the display.

Following is a list of options in the boot code service menu.

Boot Loader Service Menu Options

Menu Option	Description
CHANGE INTERNET ADDRESS	This option is used when changing the internet protocol (IP) address.

WARNING
Duplication of an Internet address on a network causes data loss and possible Unity Network problems. If you change the factory assigned Internet address, you must record all other Internet addresses used on your network to avoid duplication.

SHOW INSTALL OPTIONS	This option lists the options installed on the patient monitor.
CLEAR CONFIGURATION MEMORY	This option erases all patient histories and programmed defaults in the monitor's protected memory. Clearing the configuration memory returns the patient monitor defaults to the factory installed defaults.
SET CONFIGURATION	This menu contains options for configuring the patient monitor. Refer to "Boot Code Settings" on page 4-16.
VIDEO TEST SCREENS	Various color screens for testing the display.
BATTERY SIMULATION	This option is for engineering use only.
WAKE UP BATTERY	This option is used when the battery is dead. Refer to "How to Wake Up the Battery" on page 5-8.
OPTIONS MENU	A unique password is required for each option. Contact your sales/service representative to obtain a password. You must provide your product serial number and internet address. (The internet address is displayed in the Boot Code banner information.)

Main Menu Service Mode

The Service Mode menu option items provide the service technician access to general and technical built-in software functions of the patient monitor. Only persons responsible for configuring and maintaining the patient monitor should access the service mode menu option items.

The service technician can use the Service Mode menu to:

- relay software information to design engineers,
- calibrate and troubleshoot NBP functions of the patient monitor,
- set admit menu options, operating mode of the patient monitor, and monitor default password,
- configure the patient monitor unit name, bed number and Internet address for use on the network, and
- enter or change the time and date on the patient monitor.

WARNING
The Boot Loader Service Menu and the Service Mode menus are intended for qualified personnel only. Do not 'experiment' with any commands found in the service menus. Experimenting with service commands can lead to lost patient data, damaged operating system software for the patient monitor, and even affect the Unity Network.

Access the Service Mode

Access the Service Mode menu starting from the Main menu.

1. Select *MORE MENUS* > *MONITOR SETUP* > *SERVICE MODE* >
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407).

Service Mode Options

Following is a list of options in the main code service menu.

Service Mode Menu Options	
Menu Option	**Description**
REVIEW ERRORS	For advanced troubleshooting by GE engineers. Error log data can be transferred over the network to a central station and then loaded onto a diskette for review. Refer to "Error Messages" on page 6-5 for details.
CALIBRATE	For checkout or calibration of the noninvasive blood pressure, ECG analog output, BP analog output, CO_2 service, and SAM service menu functions of the patient monitor.
BATTERY SERVICE	Provides battery data.

NOTE
If an *INCOMPAT* message displays in the Manufacturer Name column and *UNKNOWN* displays in all other columns, the installed battery is incompatible.

PATIENT-MONITOR TYPE	For selecting the type of patient monitor desired, i.e adult, neonatal or operating room. Refer to "Patient-Monitor Type" on page 4-12 for detailed procedures.

WARNING
Changing the patient-monitor type will default the admit function to Standard configuration. Different alarms and parameters are activated for each selection.

NOTE
The keypad/remote control is DIDCA programmed for specific patient monitor types. The error message, "*WARNING: REMOTE MISMATCHED WITH MONITORING MODE*" displays if the patient monitor and keypad/remote control do not match.

Service Mode Menu Options (Continued)	
Menu Option	**Description**
MENU SETUP	Provides the following sub-menus: (Refer to "Service Mode Settings" on page 4-11 for detailed procedures.) ■ *ADMIT MENU: STANDARD* Allows you to determine the function of the patient monitor. The four variables include stationary or ambulatory (telemetry) patient monitoring with a monitor that always stays in one room (STANDARD) or a monitor that moves from room to room (*ROVER*). ■ *MONITOR DEFAULTS PASSWD* Allows you to set the patient monitor so that a password is Required or Not Required for entry into the Monitor Defaults menu section. If selected, the password will be the same as the Service Mode Menu password.
MONITOR SETTINGS	Provides the following sub-menus: (Refer to "Service Mode Settings" on page 4-11 for detailed procedures.) ■ *SET UNIT NAME* Allows changes to the care unit name. After initial setup, this name should not be changed or communication to the central station will be corrupted. Note that the care unit name must be registered exactly the same in the central station and the patient monitor. ■ *SET BED NUMBER* Allows changes to the bed number. After initial setup, this number should not be changed or communication to the central station will be corrupted. Note that the bed number must be registered exactly the same in the central station and the patient monitor. ■ *SET INTERNET ADDRESS* Allows changes to the internet (IP) address. An incorrect internet address may also prevent the patient monitor from viewing other monitors on the network even though the unit names match. Whether or not this can occur depends on the network topology at the installed site.

WARNING

Duplication of an internet (IP) address on a network causes lost data. If you change the factory assigned internet address, you must first record all other internet addresses used on your network to avoid duplication.

NOTE

An incorrect internet address may also prevent the patient monitor from viewing other monitors on the network even though the unit names match. Whether or not this can occur depends on the network topology at the installed site.

Service Mode Menu Options (Continued)	
Menu Option	**Description**
MONITOR SETTINGS (cont.)	■ *CONFIGURE WIRELESS LAN* Enable and configure the wireless LAN option. (Refer to "Confirm/Configure Wireless LAN" on page 4-14 for detailed procedures.) ■ *WIRELESS LAN STATUS* Displays wireless LAN status. ■ *STORE DEFAULTS FOR NETWORK TRANSFER* Saves the patient monitor defaults for transfer to another patient monitor with the same software version, software package, patient monitor type, and country code. It stores all patient monitor defaults, (including WLAN configuration) custom default names, and 12 SL location and site. ■ *SET LOCATION ID* Enter the location identification for the MUSE system. ■ *SET SITE NUMBER* Enter a site number if your institution has multiple buildings. A MUSE system can be used as a site number.
COPY UNIT DEFAULTS	Use to copy patient monitor defaults from one patient monitor to another patient monitor. Refer to "Configuration" on page 4-1 for detailed procedures.
PRINT TEST PATTERN	Allows you to run a graph test pattern. The choices are Start and Stop.
TIME AND DATE	Allows changes to the time and date and may affect the time and date for the entire monitoring network. (Refer to "Set Time and Date" on page 4-21 for detailed procedures.)

WARNING
Loss of patient history. This menu should rarely be used because patient histories will be lost.

Procedures

Listed below are the patient monitor settings that can be configured. Each procedure is described on the next pages.

From the Main Menu

- "Set Print Locations" on page 4-10

From Service Mode

- "Set Unit Name" on page 4-11
- "Set Bed Number" on page 4-11
- "Patient-Monitor Type" on page 4-12
- "Admit Menu" on page 4-13
- "Confirm/Configure Wireless LAN" on page 4-14

From Boot Code

- "Set Defib Sync Voltage and Pulse Width" on page 4-16
- "Set Line Frequency" on page 4-16
- "Set CIC and QS Protocol" on page 4-17
- "Set MUSE System Protocol" on page 4-17
- "Transcutaneous Pace Blank Length" on page 4-17
- "Set Country Selection" on page 4-18
- "Set Language" on page 4-18
- "Enable/Disable AFIB Identification" on page 4-19
- "Enable/Disable IntelliRate" on page 4-19
- "Analog Out Buzz" on page 4-20

Also see "Advanced User Procedures" on page 4-21 to

- "Set Time and Date" on page 4-21
- "Transfer Monitor Defaults" on page 4-22

After completing all necessary procedures, go to the "Checkout" on page 8-1.

Set Print Locations

NOTE

Dash patient monitors and printers must be networked prior to setting locations.

Access the Manual Print Location option as follows.

1. Select *MORE MENUS* > *MONITOR SETUP* > *PRINT SETUP* > *PRINT LOCATION* > *MANUAL PRINT LOCATION*.
2. Using the **Trim Knob** control, choose the manual print location from the list.
3. Select *PRINT ON ALARM LOCATION*.
4. Using the **Trim Knob** control, choose the alarm print location from the list.
5. Select *PRINT WINDOW LOCATION*.
6. Using the **Trim Knob** control, choose the print window location from the list.
7. Select *12 LEAD PRINT LOCATION*.
8. Using the **Trim Knob** control, choose the 12 lead print location from the list.

Service Mode Settings

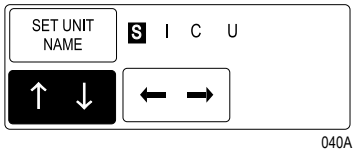
From the Main Menu,

1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407)

Set Unit Name

Up to seven characters are used to identify the care unit. These characters display at the top right of the screen immediately preceding the bed number.

1. Enter service mode (See "Service Mode Settings" on page 4-11) and select *MONITOR SETTINGS > UNIT NAME.*

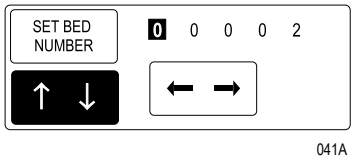


2. Use the **Trim Knob** control to select and change each character. Up to seven characters may be entered.
3. Select *SET UNIT NAME* and press the **Trim Knob** control to exit.

Set Bed Number

The bed number identifies a particular patient bed. Up to five characters are used to identify bed number. This number displays at the top right of the screen.

1. Enter service mode (See "Service Mode Settings" on page 4-11) and select *MONITOR SETTINGS > UNIT NAME > SET BED NUMBER.*



2. Use the **Trim Knob** control to select and change each character. Up to five characters may be entered.
3. Select *SET BED NUMBER* and press the **Trim Knob** control to exit.

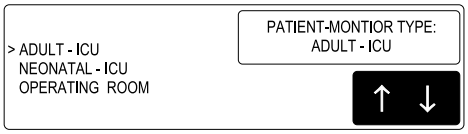
Patient-Monitor Type

The Patient-Monitor Type selection determines the type of patient monitor desired, i.e., adult, neonatal or operating room. Different alarms and parameters are activated for each selection.

CAUTION
Each time the patient-monitor type is changed, the *ADMIT MENU* function defaults to STANDARD configuration. Be aware that some patient alarms and parameters may be changed.

NOTE
The keypad/remote control is DIDCA programmed for specific patient monitor types. The error message, "*WARNING: REMOTE MISMATCHED WITH MONITORING MODE"* displays if the patient monitor and keypad/remote control do not match.

1. Enter service mode (See "Service Mode Settings" on page 4-11) and select *PATIENT-MONITOR TYPE*. Be sure to read the information in the Attention box before changing anything.



2. Rotate **Trim Knob** control to select the type of environment the patient monitor will be used in.
3. Press **Trim Knob** control to exit. Your selection displays at the top left of the screen after the date.

Admit Menu

The Admit Menu selection determines the function of the patient monitor. Before configuring the Admit Menu, you must know if the patient monitor will be used for standard adult, neonatal, or operating room monitoring, and if the patient monitor will be moved from room to room. All combinations are explained below.

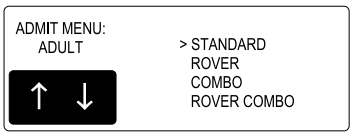
- Standard—configures the patient monitor to stay in one room for stationary monitoring only. Patient monitors not connected to the Unity Network (Ethernet connection) must use STANDARD configuration only.
- Rover—configures the patient monitor to move from room to room for stationary monitoring only.
- Combo—configures the patient monitor to stay in one room for both stationary and ambulatory (telemetry) monitoring. This patient monitor displays all Tram module data combined with ECG data for ambulatory patients.

  NOTE

  Users should be aware of a possible time discrepancy between the waveforms from the Telemetry device and the waveforms hard-wired to the Dash patient monitor. Users should not consider these waveforms to be synchronous. If absolute synchronicity is desired, Combo mode should be discontinued and the ECG waveforms should be acquired via the hard-wired bedside patient monitor.

- Rover Combo—configures the patient monitor to move from room to room for both stationary and ambulatory (telemetry) monitoring.

1. Enter service mode (See "Service Mode Settings" on page 4-11) and select *MENU SETUP > ADMIT MENU*.

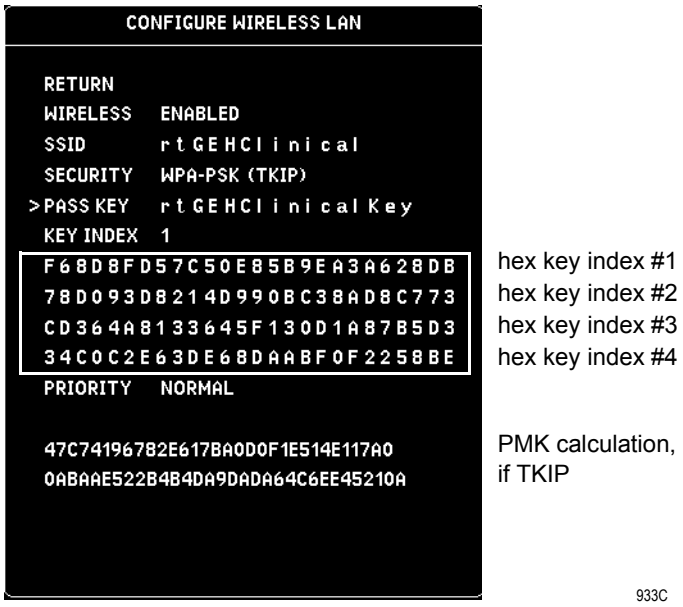


2. Use the **Trim Knob** control to select the function of the patient monitor.
3. Press **Trim Knob** control to exit.

Confirm/Configure Wireless LAN

Confirm or configure the optional Wireless LAN as follows.

1. Enter service mode (See "Service Mode Settings" on page 4-11) and select *MONITOR SETTINGS* > *CONFIGURE WIRELESS LAN*.



2. Select *WIRELESS* and set to *ENABLED*.
3. Select and enter *SSID*. If you change the SSID for TKIP, you must enter the *PASS KEY* (even if it didn't change) to recalculate the PMK.
4. For 802.11b, select and enter *SECURITY*.
5. If WEP, enter *PASS KEY* or hex key and *KEY INDEX* to match the configuration on the access point. (See the definitions table on the following page.)
   If TKIP, enter *PASS KEY*. PMK is calculated and displayed below the hex keys. Hex keys display although not used by TKIP.

NOTE

- Entering a WEP hex key clears out the pass key.
- The Hospital IT or a group that is responsible for the hospital's wireless network can obtain the SSID and security settings (type, pass key and key index) for the 802.11b wireless Dash.
- Type in the *PASS KEY* exactly, using no extra spaces. *PASS KEY* entries must be at least 8 characters for TKIP. The message *TKIP KEY MUST BE AT LEAST 8 CHARACTERS* displays.
- The *SSID* and *PASS KEY* entries are limited to 20 characters of upper/lower case letters and numbers.
- The *SSID* and *PASS KEY* entries are case sensitive.
- Do not use special characters or quotes.

6. Select *PRIORITY*. Set to *NORMAL* unless otherwise specified by the network specialist.
7. Manually reboot the Dash patient monitor.

Term	Definition
SSID	SSID is an acronym for Service Set Identifier.The SSID is a sequence of numbers and characters that represents the ID, a name, of the wireless network. For the 802.11b wireless Dash to connect wirelessly, the SSID from the wireless network must match the SSID of the 802.11b wireless Dash. A 802.11b wireless Dash has a default SSID of rtGEHClinical.
SECURITY	A 802.11b wireless Dash provides three levels of security: NONE, WEP 128 bit, WPA-PSK (TKIP). · ■ NONE provides no security to the wireless communication ■ WEP 128 bit, Wired Equivalency Privacy, provides some level of security, but it is less secure than WPA-PSK (TKIP). ■ WPA-PSK (TKIP), Temporal Key Integrity Protocol, is more secure than WEP. TKIP has a method to change it's security key for each data connection every second. For the 802.11b wireless Dash, WPA-PSK (TKIP) is recommended.
PASS KEY	Pass Key is equivalent to passphrase. This is a sequence of words for the wireless Dash to connect to a security enabled wireless network, WEP 128 bit or WPA-PSK (TKIP). When WEP 128 bit security is selected, the wireless Dash generates the 26 hex characters for four different keys, displayed in four different rows (1st row represents a key index of one, 2nd row for a key index of two, 3rd row for a key index of three and 4th row for a key index of four). One of these keys needs to match the WEP 128 security setting in the access point for the wireless Dash to communicate properly. When WPA-PSK (TKIP) is selected, the wireless Dash will not generate the 26 hex characters. Pass Key or passphrase needs to match the WPA-PSK (TKIP) setting in the access point in order for it to communicate properly.
KEY INDEX	(only required for WEP 128 bit) When WEP 128 bit security is selected, the wireless Dash and the wireless network need to share a same key index.

Boot Code Settings

To activate the Boot Code,

1. With power on, hold down **NBP Go/Stop** (or **NBP Auto** on Dash 5000) and **ZERO ALL**.
2. Press and release the **Trim Knob** control.
3. Keep holding **NBP Go/Stop** (or **NBP Auto**) and **ZERO ALL** until the Boot Code information appears on the display.

Set Defib Sync Voltage and Pulse Width

The patient monitor controls the analog out signal used to trigger a defibrillator. Refer to the defibrillator manufacturer's manual for the required pulse amplitude and duration.

Configure or change the Marker Out signal of the **DEFIB SYNC** connector as follows.

1. Activate Boot Code ("Boot Code Settings" on page 4-16) and select *SET CONFIGURATION* menu option.
2. In the Configuration Menu, select:
   - *1 Defib Sync Voltage:* and choose *5V* or *12V* amplitude.
   - *2 Defib Sync Pulse Width:* and choose *10 ms* or *100 ms* for pulse duration.
3. Select *Exit* and wait for the patient monitor to display the message, *"Writing settings to EEPROM..."*
4. Manually reboot the patient monitor to implement this change.

Set Line Frequency

Configure or change the patient monitor line frequency to 50 or 60 Hz as follows. The default is 60 Hz.

1. Activate Boot Code ("Boot Code Settings" on page 4-16) and select *SET CONFIGURATION* menu option.
2. Select *Line Frequency* then choose 50 Hz or 60 Hz line frequency.
3. Select *Exit* and wait for the patient monitor to display the message, *"Writing settings to EEPROM..."*
4. Manually reboot the patient monitor to implement this change.

Set CIC and QS Protocol

The CIC and QS Protocol default setting is Seg50/51 (Segment 50/51) and should not be changed. However, future products may require Hilltop protocol. Use the Boot Code Service Menu to change the CIC Protocol and QS Protocol.

Set MUSE System Protocol

The patient monitor transmits 12SL and ACI-TIPI data over the optional Unity Network to the MUSE System and ST Guard. The formats used for this process are Hilltop and Segment 50/51. Since the Segment 50/51 format does not support 500 Hz ECG data or ACI-TIPI, records originally stored on the MUSE System in Hilltop format cannot display at the ST Guard. The default setting is Hilltop.

1. Activate Boot Code ("Boot Code Settings" on page 4-16) and select *SET CONFIGURATION* menu option.
2. Select *MUSE System Protocol* then choose *Hilltop* or *Seg50/51*.
   - Hilltop—Sends 12SL records to the MUSE System in Hilltop format. The 12SL records contain 500 samples per second of ECG data. ST Guard will NOT be able to retrieve 12SL records stored on the MUSE System in Hilltop format.
   - Seg50/51—Sends 12SL records to the MUSE System in Segment 50/51 format with MAC Rhythm statements. The 12SL records stored on the MUSE System contain 240 samples per second of ECG data. ST Guard can retrieve 12SL records from the MUSE System. ACI-TIPI data can NOT be retrieved at the MUSE System if this protocol is selected.
3. Select *Exit* and wait for the patient monitor to display the message, *"Writing settings to EEPROM..."*
4. Manually reboot the patient monitor to implement this change.

   NOTE

   Before you can transmit data to the MUSE System and ST Guard, you must set up the MUSE system's Location ID and Site Number.

   DO NOT configure MUSE system's location at Site 0. Site 0 appears invalid to MUSE and any message coming from a device on Site 0 is dumped.
5. Refer to "Service Mode Settings" on page 4-11 and select *MONITOR SETTINGS* > *SET LOCATION*, then select *SET SITE NUMBER*.

Transcutaneous Pace Blank Length

This menu option is reserved for future use and should not be changed.

Set Country Selection

Select *DEFAULT* or *FRANCE* to choose a particular set of GE factory defaults.

1. Activate Boot Code ("Boot Code Settings" on page 4-16) and select *SET CONFIGURATION* menu option.
2. Select *Country Selection* and choose language.
3. Select *Exit* and wait for the patient monitor to display the message, *"Writing settings to EEPROM..."*
4. Manually reboot the patient monitor to implement this change.

Set Language

Select *Set Language* to change the language of the displayed text.

1. Activate Boot Code ("Boot Code Settings" on page 4-16) and select *SET CONFIGURATION* menu option.
2. Select the *SET LANGUAGE* menu option.
3. Select the appropriate language.
4. Manually reboot the patient monitor to display the new language.

French Language Information

When the patient monitor Locale (language) is set to French_France, alarm pause duration is three minutes. Refer to the Alarms chapter in the operator's manual.

Czech, Hungarian, Polish, or Russian Language Information

Special characters within alarm broadcasts, messages, patient name, site name, or location fields that are sent over the optional Unity Network cannot be displayed by equipment that does not support these languages. Special characters may appear as either blanks, asterisks, a series of square boxes, or no character is displayed at all because the ability to display Cyrillic (Russian alphabet) and special Czech, Hungarian, or Polish characters does not exist on this equipment.

Chinese and Japanese Language Information

When the patient monitor Locale (language) is set to Chinese or Japanese, the following conditions apply:

- Text for alarm broadcast over the optional network is in English.
- All text input is in English only (i.e., text for unit name, bed name, patient information, and custom default name).

Enable/Disable AFIB Identification

NOTE

This feature is already enabled if the Cardiac software option is purchased.

Select *AFIB Identification* to enable or disable the atrial fibrillation detection feature.
To verify the option has been enabled on the patient monitor,

1. Select the following menu options: *MORE MENUS* > *MONITOR SETUP* > *SOFTWARE CONFIGURATION*.
2. Verify that *ATRIAL FIB* is listed under *"ENABLED SOFTWARE OPTIONS."*

To change the status of this feature,

1. Activate Boot Code ("Boot Code Settings" on page 4-16) and select *SET CONFIGURATION* menu option.
2. Select the *AFIB Identification* menu option.
3. Select *enabled* to activate this option, or *disabled* to deactivate this option.
4. Select *Exit* and wait for the patient monitor to display the message, *"Writing settings to EEPROM..."*
5. Manually reboot the patient monitor to implement this change.
6. Refer to the operator's manual to configure the patient monitor to use this feature.

Enable/Disable IntelliRate

IntelliRate heart rate calculation feature is enabled from the factory.
To verify the option has been enabled on the patient monitor,

1. Select the following menu options: *MORE MENUS* > *MONITOR SETUP* > *SOFTWARE CONFIGURATION*.
2. Verify that *ECG INTELLIRATE* is listed under *"ENABLED SOFTWARE OPTIONS."*

To change the status of this feature,

1. Activate Boot Code ("Boot Code Settings" on page 4-16) and select *SET CONFIGURATION* menu option.
2. Select the *IntelliRate* menu option.
3. Select *enabled* to activate this option, or *disabled* to deactivate this option.
4. Select *Exit* and wait for the patient monitor to display the message, *"Writing settings to EEPROM..."*
5. Manually reboot the patient monitor to implement this change.
6. Refer to the operator's manual to configure the patient monitor to use this feature.

Analog Out Buzz

Select *Analog Out Buzz* to identify an ECG or an invasive BP "leads off" condition via a supported analog out device. The default is 0 volts.

1. Activate Boot Code ("Boot Code Settings" on page 4-16) and select *SET CONFIGURATION* menu option.
2. Select the *Analog Out Buzz* menu option.
3. Select *60Hz sine wave* to display a 60 Hz sine wave, or select *0 volts* to display a flat line.
4. Select *Exit* and wait for the patient monitor to display the message, *"Writing settings to EEPROM..."*
5. Manually reboot the patient monitor to implement this change.

Completion

The patient monitor is now ready for normal operation. At this time, perform procedures in "Checkout" on page 8-1.

Advanced User Procedures

The following procedures are for advanced users only. These procedures should rarely be used, and only experienced technicians should proceed.

Procedures

The following procedures are discussed in this chapter.

- Set Time and Date
- Transfer Monitor Defaults

Set Time and Date

Change the time only when the system is switched to or from daylight savings time.

NOTE

When a patient monitor is first connected to the optional Unity Network, the time and date is automatically updated from the network time.

WARNING

Loss of patient data history. Changing the time or date settings may result in the loss of patient data history. If one patient monitor's time or date is changed, all patient monitors on the network "listen" and follow suit within 3-5 seconds. Changing the time base of one patient monitor may cause some loss of patient data history for all the patient monitors on the network.

The following procedure explains how to use the TIME AND DATE option in the patient monitor SERVICE MODE menu.

1. Access the Time and Date menu starting from the Main Menu. Select *MORE MENUS* > *MONITOR SETUP* > *SERVICE MODE*.
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407)
3. Select *SET TIME* and use the **Trim Knob** control to change the time. The time displays as a 24-hour military clock.
4. Select *SET DATE* and use the **Trim Knob** control to change the date.

Transfer Monitor Defaults

NOTE

Transfer Monitor Defaults feature is part of the Unity Network software option and is available in software version 3 or later. You must purchase and enable this software option before you can transfer patient monitor defaults.

The patient monitor defaults set on one patient monitor (server) may be transferred to another patient monitor (client), provided that the client patient monitor shares the following:

- the same software revision (version),
- the same patient-monitor type (i.e. ADULT, NEO, or OR),
- the same wireless LAN configuration (if applicable),
- the same software package (i.e. Basic, Cardiac, Cardiopulmonary), and
- the same country code (i.e. Default or France).

The following defaults transfer when using this feature:

- all patient monitor defaults
- wireless LAN configuration (if applicable)
- custom default names
- 12 SL location
- 12 SL site

Store Monitor Defaults for Transfer

To transfer monitor defaults, they must be set, then stored on the patient monitor that is used as the server.

1. At the server patient monitor, set up the monitor defaults you want to store. Refer to the following sections of the operator's manual for reference:
   - Defaults Worksheet located in the preface of the manual. These are blank and allow you to enter your own default settings.
   - Monitor Setup chapter.
   - Adult ICU, Neonatal ICU, Operating Mode Factory Default Appendices.
2. When defaults are set, start from the Main Menu and select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
3. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407)
4. Select *MONITOR SETTINGS.*
5. Select *STORE DEFAULTS FOR NETWORK TRANSFER.*
6. Select *YES* to the confirmation popup menu.

Copy Stored Monitor Defaults

WARNING
Loss of Defaults. Copying patient monitor defaults from the server patient monitor erases all of the patient monitor defaults on the client patient monitor.

To copy patient monitor defaults from the server patient monitor, the client patient monitor must be in the Discharged state. If the client patient monitor is set to the OR patient-monitor type, it must not be in Combo or Rover Combo Admit mode.

NOTE
Make sure that the client patient monitor shares the same configuration as the server patient monitor. Refer to "Transfer Monitor Defaults" on page 4-22.

1. At the client patient monitor, start from the Main Menu and select *MORE MENUS* > *MONITOR SETUP* > *SERVICE MODE*.
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407)
3. Select *COPY UNIT DEFAULTS*.
4. Select *SELECT UNIT TO COPY MONITOR DEFAULTS FROM*.
5. From the list of units on the Unity Network, choose the unit the server patient monitor is in.
6. Select *SELECT BED TO COPY MONITOR DEFAULTS FROM*.
7. Scroll through the list of beds within the selected unit until the desired server patient monitor is found. Select it, and answer *YES* to the confirmation popup menu.

NOTE
After copying patient monitor defaults, the first set of defaults is automatically activated. If another set of defaults is desired, the user must manually select it from the Recall Defaults menu.

Wireless LAN configuration settings that are transferred do not take effect until the patient monitor is rebooted.

After copying patient monitor defaults from another bed (the server patient monitor), verify that the defaults were transferred and arrhythmia levels are as desired. See "Monitor Defaults Transfer" on page 6-11 for troubleshooting any errors during this process.

5 Maintenance

Maintenance Schedule

WARNING
Failure on the part of all responsible individuals, hospitals or institutions, employing the use of this device, to implement the recommended maintenance schedule may cause equipment failure and possible health hazards. The manufacturer does not, in any manner, assume the responsibility for performing the recommended maintenance schedule, unless an Equipment Maintenance Agreement exists. The sole responsibility rests with the individuals, hospitals, or institutions utilizing the device.

To ensure the patient monitor is always functional when required, qualified service personnel should perform the following regular maintenance. For a detailed checklist of all maintenance items, go to "Maintenance and Checkout Checklist" on page 8-3.

- "Visual Inspection" on page 5-3—Perform a visual inspection upon receipt of the equipment, every 12 months thereafter, and prior to servicing the unit.
- "Cleaning" on page 5-4—Clean the unit upon receipt of the equipment, every 12 months thereafter, and each time the unit is serviced. Clean the print head every 12 months or as usage demands.
- "Battery Maintenance" on page 5-6—Condition the batteries once every six months or as needed.
- "Clear the Stored Patient Data Memory" on page 5-12—Admit and discharge a test patient every 12 months to clear the patient monitor's stored patient data memory.
- "Checkout" on page 8-1—Perform electrical safety tests, checkout procedures and calibration upon receipt of the equipment, every 12 months thereafter, and each time the unit is serviced.
  - Calibrate the NBP software upon receipt of the equipment, every 12 months thereafter, and each time the unit is opened for service. Calibrate the analog output BP and analog output ECG whenever these do NOT pass the analog output checkout procedure.
  - Calibrate the Mainstream End-tidal CO_2 upon receipt of the equipment, every 12 months thereafter, and each time the adapter is removed or replaced. Refer to the CO_2 chapter of the Dash 3000/4000/5000 Patient Monitor Operator's Manual.
  - Calibrate the Sidestream End-tidal CO_2 according to the documentation that came with the CO_2 module.

Visual Inspection

The patient monitor and its components should be carefully inspected prior to installation, once every 12 months thereafter and each time the equipment is serviced.

- Carefully inspect the equipment for physical damage to the case, the display screen, and the keypad. Do not use the patient monitor if damage is determined. Refer damaged equipment to qualified service personnel.
- Inspect all external connections for loose connectors or frayed cables. Have any damaged connectors or cables replaced by qualified service personnel.
- Inspect the display face for marks, scratches, or other damage. Physical damage to a flat panel display glass may pose an implosion hazard. Have the flat panel display replaced by qualified service personnel if necessary.
- Safety labels and inscription on the device are clearly legible.

Cleaning

Precautions

Use one of the following approved solutions:

- Cidex solution, or
- Sodium hypochlorite bleach (diluted), or
- Mild soap (diluted)
- Lint-free cloth
- Dust Remover (compressed air)

To avoid damage to the equipment surfaces, *never* use the following cleaning agents:

- organic solvents,
- ammonia-based solutions,
- acetone solution,
- alcohol-based cleaning agents,
- Betadine solution,
- a wax containing a cleaning substance, or
- abrasive cleaning agents.

Clean the Display

Use a soft, clean, lint-free cloth dampened with a glass cleaner to clean the display.

CAUTION
To avoid getting liquid into connector openings, do not spray glass cleaning or general cleaning solutions directly onto the product's surface.

Clean the Exterior

Clean the exterior surfaces with a clean, lint-free cloth and one of the cleaning solutions listed in the table above.

- Wring the excess solution from the cloth. Do not drip any liquid into open vents, switches, plugs, or connectors.
- Dry the surfaces with a clean lint-free cloth.

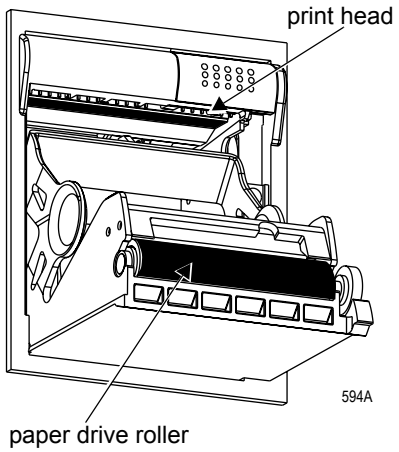
Clean the Print Head

Heavy usage causes debris to build up on the print head. This build can cause the printed images to appear distorted. It is recommended that this procedure be performed when necessary, depending on usage.

Materials Required

A nonabrasive material/cloth and isopropyl alcohol are all that are necessary to perform this procedure.

Procedure



1. Disconnect the power cord from the mains source.
2. Open the writer door to expose the print head.
3. Remove paper roll.
4. Locate print head shown in the figure above. A flashlight may help illuminate the print head for closer examination.
5. Wipe the print head with alcohol and a nonabrasive material/cotton swab in an side to side motion. Continue wiping until the cloth/swab wipes clean.
6. Wipe paper drive roller clean of any bits of paper and debris with alcohol and a nonabrasive material.

Battery Maintenance

How to Charge the Battery

The battery can be charged by one of two methods:

- Outside of a patient monitor by using the Cadex SMart Two+ charger.
- Inside a patient monitor that is connected to an AC power source.

NOTE

To extend the life of the battery, GE recommends that you charge the battery using the external Cadex SMart Two+ charger.

Charging the Battery With a Cadex SMart Two+ Charger

1. Insert the battery into the battery charger. The **RUN** LED lights.
2. Leave the battery in the battery charger until the **READY** LED lights.

NOTE

If the **FAIL** LED lights, remove the battery from the battery charger and reinsert it. This should correct any battery charger time out errors. However, if this does not correct the battery charger time out errors, then the battery is defective and should be replaced.

Charging the Battery Inside a Patient Monitor

NOTE

Non-recommended (incompatible) batteries will NOT charge in the Dash patient monitor.

The battery is charged whenever the patient monitor is connected to an AC power source.

When you store the battery inside of a patient monitor that is connected to an AC power source (a state known as “floating”), the battery will self-discharge to less than 90% of its Full Charge Capacity after approximately two weeks (depending upon the temperature of the battery). At this time, the patient monitor will automatically recharge the battery to 100% of its Full Charge Capacity.

How to Condition the Battery

The battery can be conditioned by one of two methods:

- Outside of a patient monitor by using the Cadex SMart Two+ charger.
- Inside a patient monitor that is connected to an AC power source.

NOTE

To extend the life of the battery, GE recommends that you condition the battery using the external Cadex SMart Two+ charger.

Conditioning the Battery With a Cadex SMart Two+ Charger

A conditioning cycle using the battery charger requires approximately nine hours to complete. Complete the following steps to automatically condition the battery.

1. Insert the battery into the battery charger.
2. Press the **CONDITION** button when one of the following conditions occur:
   - While the **RUN** LED light is still flashing.
   - While the **CONDITION** LED is flashing.
3. Remove the battery from the battery charger when the **RUN** LED lights. This completes the conditioning cycle.

Conditioning the Battery Inside a Patient Monitor

NOTE

Non-recommended (incompatible) batteries will NOT condition in the Dash patient monitor.

WARNING

PATIENT RISK HAZARD — Never condition a battery while the patient monitor is connected to a patient. Serious injury or death could result.

Complete the following steps to manually condition the battery using the patient monitor:

1. Remove all batteries from the patient monitor.
2. Insert one battery into Slot A of the patient monitor.
3. Disconnect the patient monitor from the AC power source.
4. Access the patient monitor's Battery Status window to monitor the battery's Charge Level. See "Identify Battery Status Using the Battery Status Menu" on page 2-37.
5. Allow the battery to discharge to less than a 90% Charge Level.
6. Re-connect the patient monitor to the AC power source and fully charge the battery.
7. Disconnect the patient monitor from the AC power source and allow the patient monitor to run until it displays the *BATTERY LOW* message, or until the patient monitor shuts down.
8. Re-connect the patient monitor to the AC power source. Allow the battery to fully charge to complete the conditioning cycle.

How to Store the Battery

- Condition the battery before storing it. Conditioning the battery to 100% capacity increases the storage shelf-life of the battery.
- Store the battery outside of the patient monitor at a temperature between 20°C to 25°C (68°F to 77°F).
  - When the battery is stored inside a patient monitor that is powered by an AC power source, the battery cell temperature increases by 10°C to 15°C (18°F to 27°F) above the room's ambient temperature. This reduces the life of the battery.
  - When the battery is stored inside a patient monitor that is continuously powered by an AC power source and is not powered by battery on a regular basis, the life of the battery may be less than 12 months. GE recommends that you remove the battery and store it near the patient monitor until it is needed for transport.
- Re-condition a stored battery every six months to increase the storage shelf-life.

How to Wake Up the Battery

When the battery is stored for a long period of time without being charged, it will eventually lose all of its charge and "fall asleep." When the battery is "asleep," none of the LEDs on the battery will illuminate when the battery's on/off button is pressed. You must "wake up" the battery before you can use it again.

There are two methods to wake up the battery:

- Outside of a patient monitor by using the Cadex SMart Two+ charger.
- Inside a patient monitor that is connected to an AC power source.

Waking Up the Battery With a Cadex SMart Two+ Charger

NOTE
A deep discharged battery will require you to repeat the following steps more than once before the battery will "wake up."

1. Insert the battery into the battery charger and wait for the **RUN** LED light to illuminate (approximately three minutes).
2. If the **RUN** LED light does NOT illuminate, complete the following steps:
   a. Remove the battery from the battery charger.
   b. Re-insert the battery into the battery charger and let the battery trickle charge for two to three minutes while the **FAIL** LED flashes. (If the **RUN** LED light lights, ignore it.)
   c. Watch the battery charger LEDs and immediately remove the battery from the battery charger when the **FAIL** LED stops flashing AND remains illuminated, OR when both the **RUN** and **CONDITION** LEDs flash.

d. Wait for one to two seconds, then re-insert the battery into the battery charger. The **RUN** and **CONDITION** LEDs will flash for five to ten seconds while the charger initializes the battery. If the **FAIL** LED lights, remove the battery and re-insert it into the battery charger.

e. Watch the battery charger LEDs. The **RUN** LED should stop flashing and remain illuminated for approximately one minute later the **CONDITION** LED should stop flashing. At this time, the battery is awake and being charged.

Waking Up the Battery With a Patient Monitor

NOTE

Non-recommended (incompatible) batteries will NOT wake up the Dash patient monitor.

1. Connect the patient monitor to an AC power source.
2. Activate the Boot Loader program.
   a. Hold down **NBP Go/Stop** (or **NBP Auto** on Dash 5000) and **ZERO ALL** (**FUNCTION**).
   b. Press and release the **Trim Knob** control.
   c. Keep holding **NBP Go/Stop** (or **NBP Auto**) and **ZERO ALL** (**FUNCTION**) until the Boot Code information appears on the display.
3. Select *Wake Up Battery* from the Service Menu.
4. Insert the "sleeping" battery into slot **A** of the patient monitor.

   NOTE

   In some languages, slot **A** is identified as slot **1** and slot **B** is identified as slot **2**.

5. Select *Wake Up Lithium Ion Battery in SLOT A*. Then, the patient monitor applies a "wake-up" shot of current for up to 210 seconds.
6. Watch for the message, *Battery awake, run main code to charge*. The battery should now be "awake."
   - If the *"Battery awake, run main code to charge*" message appears but the battery is NOT awake, the battery may be in a deep discharge state. You should repeat step 5 at least four more times to give the battery additional "wake-up" shots of current.
7. Quickly reboot (or power cycle) the patient monitor to begin charging the batteries. The patient monitor's illuminated yellow-colored **CHARGING STATUS** LED indicates that the battery is being charged.

   NOTE

   The patient monitor will not charge the battery while it is running the Boot Loader program.

How to Replace the Batteries

1. Open the battery doors on the left side of the patient monitor, along the bottom.
2. Remove the faulty batteries.

   NOTE

   Depending on your model, the battery compartment may be a single plastic door or two silicone doors.

581B

635A

3. Replace with a new battery. The patient monitor supports up to two exchangeable lithium-ion batteries. Install the battery with the connection pins facing down and inserted first.
4. Close the battery covers.
5. Verify that the patient monitor operates correctly.
   a. Confirm that the Battery IDs with a battery icon displays in the lower right corner of the patient monitor.
   b. Verify that the Battery LEDS illuminate either green or amber.

Rechargeable Battery Recycling

When the battery no longer holds a charge, it should be replaced. The battery is recycleable. Remove the old battery from the patient monitor and follow your local recycling guidelines.

WARNING

EXPLOSION HAZARD — DO NOT incinerate the battery or store at high temperatures. Serious injury or death could result.

In the United States and Canada, the Rechargeable Battery Recycling Corporation (RBRC) can help you locate your nearest rechargeable battery collection site. You can contact RBRC by telephone or by accessing their internet web site.

- telephone: 1-800-8-BATTERY (800-822-88379)
- internet address: www.rbrc.org

About the Cadex SMart Two+ Charger

Battery Charger LED Indicators

The following is a quick guide which identifies the meaning of the charger LEDs.

LED Indicators	Illuminated	Flashing
RUN	Charging in progress.	Initializing the battery.
RUN and CONDITION	Conditioning in progress.	
READY	Charging is complete.	
READY and CONDITION	Conditioning is complete — pass target.	Conditioning is required.
FAIL	Battery fault.	Charger fault.
FAIL and CONDITION	Conditioning is complete — fail target.	

Equipment Software Requirements

- The patient monitor must use Dash 3000/4000 software version 2A or later.
- The Cadex SMart Two+ Charger must use software version 1.31 or later.

Clear the Stored Patient Data Memory

Admit and discharge a test patient every 12 months to clear the patient monitor's stored patient data memory.

6 Troubleshooting

Fault Analysis

Overview

The symptoms and solutions in this chapter represent only a few of the faults that you may encounter and are not intended to cover every possible problem that may occur.

A systematic approach to the diagnosis of problems as well as a general understanding of the architecture, both hardware and software, of the patient monitor are essential to ensure successful troubleshooting of a device. GE recommends formal service training before repairs are attempted. These troubleshooting procedures combined with training provide the service technician with skills necessary to service and repair a patient monitor in the event of a malfunction.

Required Tools/Equipment

- Standard set of hand tools
- Patient simulator with cables
- Digital multimeter

Problems

Before starting any detailed troubleshooting, complete a thorough visual inspection of the following.

- All cable connections secure?
- Devices properly powered?
- Connected to a proper power source?

Problem	Possible Reason	Solution
General The unit is plugged in, but it does not switch to AC from battery power.	■ The output voltage of the power supply is inadequate for the processor PCB to recognize.	■ Perform "Power Outlet Test" on page 8-6 to confirm AC power. ■ Replace the power supply. ■ Replace the processor/power management assembly.
Alarm Audio Audio does not sound. Go to the Alarm Help Menu and select "Crisis." Listen for the three-beep audio.	■ The speaker cable is loose or disconnected. ■ The speaker failed. ■ The audio circuit on the processor PCB failed.	■ Restore the cable connections. ■ Replace the speaker. ■ Replace the Replace the processor/power management assembly.
Waveform Display	■ Patient cables are bad. ■ The acquisition PCB, DAS Assembly or power supply PCB failed.	■ Perform appropriate sections of the "Data Acquisition Tests" on page 8-54 depending on the waveform problem.

Problem	Possible Reason	Solution
Optional Writer		
No paper comes out, even though "Graphing" is displayed.	■ Graph locations are set incorrectly.	■ With the **Trim Knob** control, select *MONITOR GRAPH SETUP*, and *GRAPH LOCATION*. Verify that MANUAL, ALARM, and PRINT locations are set properly.
Paper comes out, but no graph data is shown.	■ The paper may be loaded incorrectly. ■ Print head may be dirty or defective.	■ Refer to the Operator Manual for correct paper installation. ■ Clean the printhead. Refer to "Clean the Print Head" on page 5-5 ■ Perform a graph test. If problem persists, replace the writer assembly.
Saving Message	■ Writer is busy. ■ Writer is no longer available.	■ When the graph is complete, the saved graph prints out. ■ Check the graph locations. Set the correct graph locations if necessary.
Missing segments in the graph data.	■ Print head may be dirty or defective.	■ Clean the printhead. Refer to "Clean the Print Head" on page 5-5 ■ Perform a graph test. If problem persists, replace the writer assembly.
Optional Wireless Connection		
Intermittent or no waveform.	■ Network connection bad, wireless not enabled, wireless card not communicating with access point. ■ Outside coverage area.	NOTE: There is no alarm or displayed indicator if Dash is outside the wireless coverage area. ■ Perform procedures in "Wireless LAN" on page 6-24.
Optional Alarm Light Indicator		
The red or yellow lights do not light on boot up of the patient monitor.	■ Cable may be loose or disconnected. ■ LEDs are burned out.	■ Restore the connection. ■ Replace the alarm light assembly or PCB.
Defib Sync		
"Buzz" signal comes out for ECG or BP.	■ BP is not zeroed. ■ BP is not available. ■ ECG leads fail.	■ Zero out the BP. ■ Plug in a BP cable. ■ Check patient connections.
Video Display		
There are bars/strips of pixels missing on the display in rows/columns. Or only one row/column of pixels on the display is missing or never turned on. The remaining portion of the display functions properly.	■ Possible burned-out pixels.	■ Run the display tests in the boot loader. ■ Replace the display assembly.
No display	■ Display may be in standby mode. ■ Backlight inverted may be defective.	■ Press the **POWER** button. If display still does not appear within 20 seconds, replace the display assembly. ■ Replace back light inverter.

Problem	Possible Reason	Solution
Network Connector No network connection when a network cable is connected to the patient monitor's Network Connector.	■ The Dash patient monitor is connected to a Dash Port docking station. The patient monitor's Network Connector is inactive when it is connected to the docking station. ■ Network is disabled in boot code. ■ The Dash patient monitor does not have the optional Unity Network option enabled.	■ Connect the network cable to the docking station's internet connector. ■ Enable network in boot code. ■ Purchase and enable the Unity Network option.
Remote Control The remote control does not activate the display.	■ Cable or Autoport to Mport adapter connections may be loose. ■ Remote control needs to be reset. ■ Remote control is defective.	■ Restore the connection. ■ Disconnect and securely reconnect the remote control from the patient monitor. ■ Replace the remote control with a known good one.
Masimo SET or Nellcor SPO2 Probe or module malfunction	■ Five or more consecutive hardware failures have occurred.	■ Review the input error log for Masimo or Nellcor failure codes.

Acquisition PCB Symptoms

Symptoms relative to patient signal acquisition such as missing parameter text and waveform(s) may be associated with acquisition PCB failure. It is important that you are able to distinguish the difference between the general format of the display, which is generated by the processor PCB, versus the patient signals and data that is associated with these patient signals, a function of data acquisition, which is generated by the acquisition PCB.

Processor PCB Symptoms

Symptoms with battery operation, network communications, asynchronous communications, NBP control, PCMCIA communications, analog output, audio/sound generation, and video signals as well as other display-related problems all may be associated with processor PCB failure. All of these are functions controlled by microcontroller or graphics processing circuitry located on the Processor/Power Management PCB.

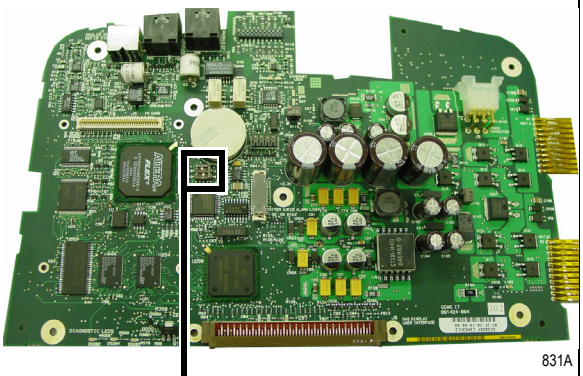
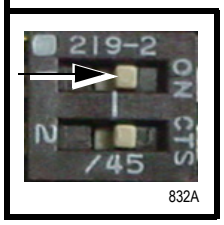
Error Messages

The following table describes error messages that may appear on the display and how to resolve the problem.

NOTE

Refer to the appropriate Dash Patient Monitor operator's manual for parameter-specific messages. Parameter messages are identified in the troubleshooting section of each parameter chapter.

Message	Possible Reason/Solution
"WARNING: The EEPROM data was found to be either INVALID or uninitialized. GE factory defaults will be stored in both the EEPROM and the monitor's configuration memory. You will be required to re-enter the network configuration, re-enable any password protected features and restore all monitor settings and site-specific defaults."	Following the EEPROM dump, restore data: 1. Restore internet address and IP address as requested by the Boot Code. 2. Power cycle. 3. If error message persists, replace processor pcb. If error message no longer occurs, re-enable any password protected features and restore all patient monitor settings and site-specific defaults via *SERVICE MENU* > *Set Configuration*, and *Options Menu*.
"WARNING: THIS VERSION OF BOOT CODE IS NOT COMPATIBLE WITH THE VERSION OF MAIN CODE CURRENTLY STORED IN FLASH. PLEASE UPDATE THE BOOT CODE."	1. Power cycle. 2. Reload Boot Code. 3. If problems persists, replace processor pcb.
"Boot Flash test FAILED." *"ERROR: The Boot Code stored in Flash is not valid. Main Code cannot be loaded until valid Boot Code exists."*	1. Power cycle. 2. Reload Boot Code. 3. If problems persists, replace processor pcb.
"Main Flash test FAILED." *"ERROR: The Main Code stored in flash is not valid."*	1. Power cycle. 2. Reload Boot Code. 3. If problems persists, replace processor pcb.
"Static RAM test FAILED." *"ERROR: The SRAM memory test failed. Main Code will not be loaded unless this test passes. Reboot the monitor to repeat testing."*	Replace processor pcb.
"Real Time Clock FAILED - will not start." *"WARNING: The real time clock chip is not running. Main Code cannot be loaded until this chip is started. Attempting to start real time clock..."* Followed by either: *"The real time clock was started. Select Start Patient Monitoring to load and execute Main Code."* Or *"ERROR: Unable to start the real time clock."*	If problem persists and error message displays, replace processor pcb.
PREVENTIVE MAINTENANCE REQUIRED	Perform all of the maintenance procedures listed under, "Maintenance Schedule" on page 5-2.

Message	Possible Reason/Solution
Internal lithium battery is LOW. **NOTE** These messages are displayed while the patient monitor powers up. Once the "Internal lithium battery is LOW" message appears, the patient monitor will complete all the power-up tests. Then, after the last test is completed, the following message will be displayed on the boot loader screen. *ONE OR MORE POWER-UP TESTS HAVE FAILED ** SERVICE MAY BE REQUIRED ** DO YOU WISH TO CONTINUE MONITORING ANYWAY?* *1 = no, 2 = yes*	The processor pcb battery may be depleted. 1. Select *NO* when the message, *"DO YOU WISH TO CONTINUE MONITORING ANYWAY?"* appears. 2. Remove this patient monitor from service and use a different patient monitor to monitor the patient. 3. Contact GE Service for lithium battery replacement instructions.
	The battery switch on processor pcb battery may be in the off position. 1. Verify that switch**1** on the mini-dip switch (labeled **S1**) is in the **ON** position.  831A  832A **ON position** 2. To move the battery switch to the **ON** position, complete the following steps. a. If a plastic film is over the switch, remove and discard the plastic film. b. Use a small, flat-head screw driver to move the switch to the **ON** position. c. Complete all of the recommended checkout, electrical safety tests, calibration tests listed in "Checkout" on page 8-1.
	The processor pcb may be defective. ■ Refer to "Replace CPU/Battery Housing Assembly" on page 7-35 to replace the processor pcb.

Battery Alarms and Messages

Battery alarms occur when one of the following battery conditions occur:

- Low battery
- Empty battery
- Battery failures
- Charger failures

These Battery messages help identify the cause of a battery alarm. Battery Messages appear in three different locations of the patient monitor:

- ECG waveform area.
- Battery Status Information window.
- Battery Fuel Gauge icon.

Battery Messages Displayed in the ECG Waveform Area

The following battery messages are displayed in the ECG Waveform Area.

Battery Messages Displayed in the ECG Waveform Area

Message	Battery Alarm	Cause
BATTERY LOW	System *WARNING*	Critical Low Battery—Only 10 minutes per battery of run time remaining (10 minutes if one battery, 20 minutes if two batteries).
POWERING DOWN	System *WARNING*	Empty Battery—There is no battery run time remaining.
CHECK BATT STATUS	System *MESSAGE*	Battery Failure—A minor failure has occurred while using or charging the battery.
BATTERY ERROR	System *WARNING*	Battery Failure—A serious failure has occurred while using or charging the battery. An incompatible battery may be installed.
CHECK BATT STATUS **NOTE** *INTERNAL CHARGER FAILED*, *CALL SERVICE* also appears in the Battery Status information window.	System *MESSAGE*	Charger Failure—Charger communications have failed.

Battery Messages Displayed in the Battery Status Information Window

Battery Messages Displayed in the Battery Status Information Window		
Message	**Battery Alarm**	**Cause**
INTERNAL CHARGER FAILED, CALL SERVICE **NOTE** *CHECK BATT STATUS* also appears in the ECG waveform area.	System *MESSAGE*	Charger Failure—Charger communications have failed.
CONDITION	None	Condition —The battery is requesting a conditioning cycle.
INCOMPAT appears in the *SLOT STATUS*. All other fields in the Battery Status window display *UNKNOWN*.		Incompatible battery installed. Refer to "Exchangeable/Compatible Battery Packs" on page 2-8 for message definitions.

Battery Messages Displayed in the Battery Fuel Gauge Icon

The following battery message is displayed in the Battery Fuel Gauge icon.

Battery Messages Displayed in the Battery Fuel Gauge Icon		
Message	**Reason**	**Solution**
ERROR	The battery is asleep, faulty, or unrecognized.	The current status of the battery's health is in question. The Battery Status information window will provide more specific information about the health of the battery. See, "How to Identify Battery Charge Capacity" on page 2-35. ■ If the battery is asleep and you need to "wake up" the battery, see "How to Wake Up the Battery" on page 5-8. ■ If the battery will not "wake up" it is probably faulty and should be replaced. ■ Check the battery status screen in the Service Menu.

Writer/Printer

External

If the printer does not print:

- Ensure the writer or printer is turned ON.
- Check all cables for a good connection.
- Check configured alarms and manual print locations at the patient monitor.

Internal

If the writer does not print, check that it has paper and that the paper is loaded properly.

No Waveform at Central Station

If you do not have a waveform at the central station:

- Ensure the central station software is compatible.
- Check all cables for a good connection.
- Check the configured alarms and manual print locations at the patient monitor.
- Ensure the care unit name is the same in the patient monitor and in the central station.
- Ensure the internet protocol (IP) addresses are configured correctly.

Monitor Defaults Transfer

Below is a list of error messages that may display when performing a patient monitor defaults transfer.

Storing Monitor Defaults

Message	Description
ERROR - UNIT DEFAULTS HAVE NOT BEEN SAVED	Patient monitor defaults were not saved on the server patient monitor due to a memory error in the patient monitor.

Copying Stored Monitor Defaults

Message	Description
ERROR COPYING UNIT DEFAULTS - NETWORK ERROR	Either an error has occurred while the defaults were being transferred, or defaults have not been saved on the server patient monitor.
ERROR COPYING UNIT DEFAULTS - UNIT TYPE MISMATCH	The server and client patient monitors are set to different unit types (i.e. ADULT, NEO, or OR)
ERROR COPYING UNIT DEFAULTS - SOFTWARE VERSION MISMATCH	The server and client patient monitors have different software versions (i.e. V2C, V3A).
ERROR COPYING UNIT DEFAULTS - DATA CORRUPTION ERROR	The patient monitor defaults transferred have become corrupted, possibly due to a memory error.
ERROR COPYING UNIT DEFAULTS - SOFTWARE FEATURE LEVEL MISMATCH	The server and client patient monitors are set to different software levels (i.e. Basic, Cardiac, Cardiopulmonary).
ERROR COPYING UNIT DEFAULTS - COUNTRY CODE MISMATCH	The server and client patient monitors are set to different country codes (i.e. *DEFAULT* or *FRANCE*).

Change Internet Address

The internet address is an identification number assigned to each device on the optional Unity Network. If the internet address has been corrupted, changing it must be done in Boot Code using a unique password. Contact your sales/service representative and provide them with the serial number and internet address of the unit to obtain a password.

WARNING
Lost Data. Duplication of an internet address on a network will cause lost data. If you change the factory-assigned internet address, you must first record all *other* internet addresses used on your network to avoid duplication.

Activate the Boot Loader program as follows:

1. Hold down **NBP Go/Stop** (or **NBP Auto** on Dash 5000) and **ZERO ALL** (**FUNCTION**) on the front panel.
2. Press and release the **Trim Knob** control.
3. Keep holding **NBP Go/Stop** (or **NBP Auto**) and **ZERO ALL** (**FUNCTION**) until the Boot Loader information appears on the display.
4. Select *Service Menu* > *Option Menu* > *Change Internet Address* to acquire information required for password.

Review Errors

This procedure describes how to review the error logs of a patient monitor. If the Unity Network software option is enabled, the error logs may also be transferred over the network to a central station and copied onto diskette for further review or sent to GE personnel for review. The transferring procedure is in "Get Error Logs" on page 6-16.

WARNING
This procedure is intended for use by service personnel with advanced troubleshooting skills.

Some of the information recorded in the error logs is useful for field troubleshooting. The details included here serve as an introduction to the error logs and provide basic information about what you can learn from them.

1. Access Review Errors starting from the Main Menu. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE*.
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407)
3. Select *REVIEW ERRORS*.

The menu provides four error log choices, two for viewing error logs and two for clearing the error logs.

View Output/Input Errors

1. Select *VIEW OUTPUT ERRORS* or *VIEW INPUT ERRORS* to view one error in the log of errors.

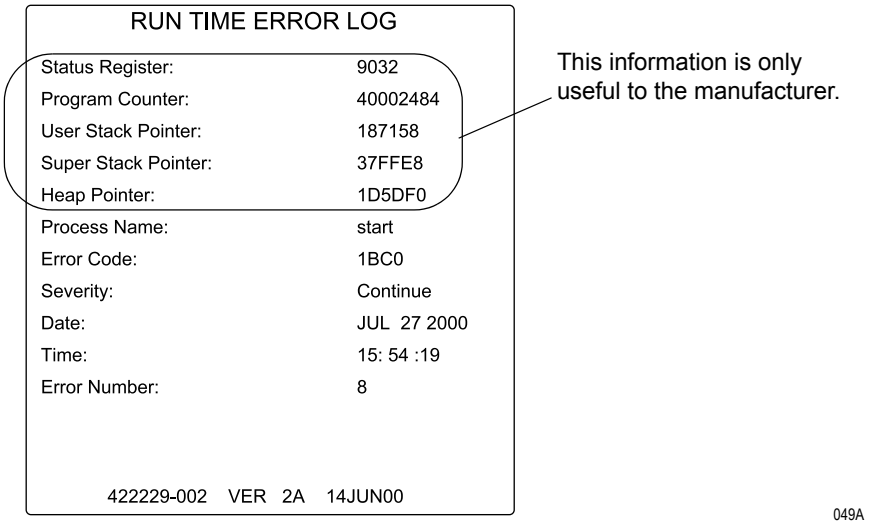
   The error log in a patient monitor holds errors that can be accessed with the *NEXT* or *PREVIOUS* command. The errors display one error at a time in the corner of the screen. Watch the error number category to keep track of which error you are viewing.

   The *VIEW OUTPUT ERRORS* provides a list of output software errors; the *VIEW INPUT ERRORS* provides a list of input software errors.

2. If you have the writer option you can print an error. Press **Print** or **Graph Go/Stop**.
3. To clear all the errors in the error log, select *CLEAR OUTPUT ERRORS* or *CLEAR INPUT ERRORS* menu option. Be aware that once the clear menu option is executed, all selected errors in memory are erased.

Useful Error Data

Below is sample error log followed by a description of parameters found in the error log.



Process Name

The name of the software task that was operating when the event/ problem occurred.

Error Code

The error log contains more than just operating system errors. Many events that have an impact upon the system are also entered into the log. The 700-series of error codes are system-initiated events. Listed below are some of the event/error codes you might find useful.

Definition of Error Codes	
Error Code	**Description**
400-4FF	Network errors were detected.
703	Diagnostic tests were completed.
70B	Internet address was changed. The network address for the patient monitor was changed. This should only be done by qualified service personnel.
70C	Video test was completed. This test should only be performed by qualified service personnel.
70E	Time was changed from this patient monitor. This helps determine how the system-wide time may have been altered.

Definition of Error Codes	
70F	Date was changed from this patient monitor. This helps determine how the system-wide date was altered.
710	Incompatible software was detected. If the main processor software finds that the software operating on the communication software incompatible, it turns off the communication (network) controller and enters this data into the error log. When the patient monitor won't "talk" to the network, looking for this entry in the error log is one part of the troubleshooting process.

NOTE

The patient monitor may be referred to as a display or scope in the error code descriptions.

Severity

Severity is a measure of how the event/error affected the system. There are three levels of severity.

- Continue—the event/error was logged, the task may have or may not have been finished, but the system was able to go on. Most log entries will have a severity of Continue.
- Fatal—the event/error was such that the task is not able to go on. Recovery was not possible. This always is followed by a WARM START.
- Forced Restart—the system was restarted by a known condition (internet address change, video test, etc).

Date and Time

The date and time the event/problem occurred.

Error Number

A sequential number that is used to identify each event/problem.

Get Error Logs

Get Logs via PC Using netUpdate

These instructions describe how to copy log files from a Dash 3000/4000/5000 patient monitor to a PC using one of the following configurations:

- PC or PC laptop connected to a Dash 3000/4000/5000 patient monitor
- PC or PC laptop connected to the Unity Network MC network.

CAUTION
LOSS OF MONITORING — There may be a temporary loss of monitoring functions until the log file retrieval is complete. Do NOT copy logs while a patient monitor is connected to a patient. Medical staff should be prepared to cover patients in need during these periods of lost monitoring functions.

Requirements

PC to Patient Monitor or Dash Port 2	PC to Unity Network MC network
■ One patient monitor software upgrade CD-ROM V5.4 or later.	
■ Microsoft® Windows® XP, 2000 or NT™ operating system ■ CD-ROM drive ■ Network card ■ Pentium II processor or higher ■ Minimum 64 MB of RAM	
Category 5 crossover patch cable (pn 415480-001)	Category 5 network patch cable (pn 408997-001)
NOTE ■ You must be able to change the IP address on the PC. ■ If you are using a PC laptop with a docking station, remove the laptop from the docking station before you begin the log transfer. ■ If you are using a PC with a wireless network connection, remove or disable the wireless network card before you begin the log transfer. ■ If the patient monitor is using a Dash Port, remove the patient monitor from the docking station before you begin the log transfer.	

Connect the PC to Dash Patient Monitor or Unity Network MC network

NOTE

Connect the patient monitor and PC to a reliable power source during the transfer process. Do NOT use battery power. A battery failure during the transfer process may result in a transfer process failure.

1. Connect one end of the category 5 crossover or network patch cable to the PC network card.
2. Connect the other end of the category 5 crossover patch cable as follows:
   - Connect to the **ETHERNET** port of the docking station if the patient monitor is using a Dash Port 2 docking station.
   - Connect to the **ETHERNET** port of the patient monitor if no docking station or network is used.
   - Connect to the Unity Network MC network Ethernet tap if transferring logs from other devises on the network. If you connect directly to the Unity Network MC network Ethernet tap, verify that the patient monitor or docking station is also connected to the Unity Network MC network Ethernet tap.
3. Power on the PC.
4. Continue with the instructions, "Change the PC's IP Address" on page 6-18.

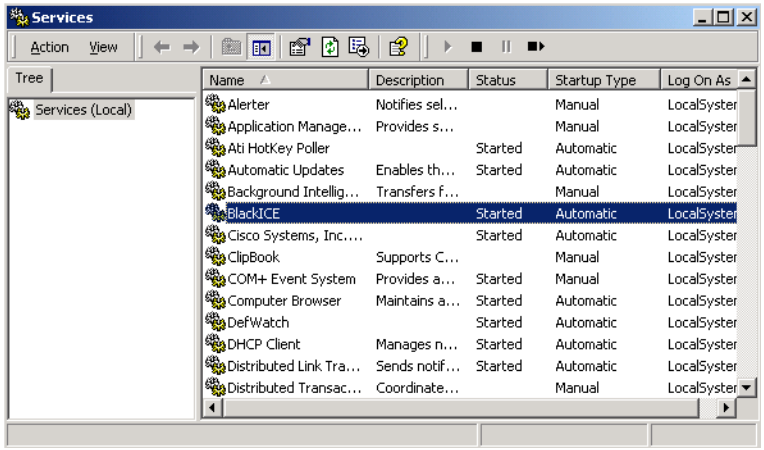
Change the PC's IP Address

	Windows XP	Windows 2000	Windows NT
1.	From the toolbar, select *Start* > *Run*.		
2.	Type **cmd** and press **Enter**.		
3.	Type **ipconfig<space>/all** and press **Enter**.		
4.	If the IP address and subnet mask are defined, record them: ■ IP address: _____ ■ Subnet mask: _____		
5.	From the toolbar, select *Start* > *Control Panel* > *Network Connections*.	From the toolbar, select *Start* > *Settings* > *Control Panel* > *Network and Dial-up Connections*.	From the toolbar, select *Start* > *Settings* > *Control Panel*.
6.	Right-click *Local Area Connection*.		Double-click *Network*.
7.	Select *Properties*.		Select the *Protocols (Configurations)* tab.
8.	Select *Internet Protocol (TCP/IP)*.		Select *TCP/IP Protocol*.
9.	Click *Properties*.		
10.	Select *Use the following IP address*.		
11.	In the *IP Address* field, type an IP address. If the patient monitor's address begins with 126, use **126.003.145.229**. ■ If using a PC connected to the Unity Network MC network, the IP address on the PC must match the institution's Unity Network MC network domain. The network domain is defined by the first numbers used in the IP address and subnet mask. If the patient monitor's address does NOT begin with 126, contact the IT department for an IP address. ■ If using a PC connected to a Dash patient monitor or Dash Port 2 docking station with a patient monitor, and the IP address does not begin with 126, change the PC IP address to match the first 3 digits of the patient monitor's address. The remaining address must be unique.		
12.	In the *Subnet mask* field, type **255.0.0.0**.		
13.	In the *Default gateway* field, type **126.003.145.229** and click *OK*.		
14.	If prompted to restart the PC, select *No*.		
15.	From the toolbar, select *Start* > *Control Panel*.	From the toolbar, select *Start* > *Settings* > *Control Panel*.	
16.	Double-click *System* and select the *Computer Name* tab.	Double-click *System* and select the *Network Identification* tab.	Double-click *Network* and select the *Identification* tab.
17.	Record the full computer name: _____		
18.	Close all open windows.		
19.	Restart the PC.		
20.	Continue with the instructions, "Disable Firewall/Networking Services" on page 6-19.		

Disable Firewall/Networking Services

If the PC is running a firewall protection or networking services, such as Cisco Systems VPN, BlackIce or a wireless network card, perform the following procedure to disable these services on the PC.

1. Select one of the following from the toolbar:
   - Windows XP: *Start* > *Control Panel* > *Administrative Tools* > *Services*.
   - Windows 2000: *Start* > *Settings* > *Control Panel* > *Administrative Tools* > *Services*.
   - Windows NT: *Start* > *Settings* > *Control Panel* > *Services*.
2. In the list of available firewall/networking services, double-click the service (e.g. BlackICE) to be disabled.


Services
Action View
Tree
Services (Local)
Name Description Status Startup Type Log On As
Alerter Notifies sel... Manual LocalSyster
Application Manage... Provides s... Manual LocalSyster
Ati HotKey Poller Started Automatic LocalSyster
Automatic Updates Enables th... Started Automatic LocalSyster
Background Intellig... Transfers f... Manual LocalSyster
BlackICE Started Automatic LocalSyster
Cisco Systems, Inc.... Started Automatic LocalSyster
ClipBook Supports C... Manual LocalSyster
COM+ Event System Provides a... Started Manual LocalSyster
Computer Browser Maintains a... Started Automatic LocalSyster
DefWatch Started Automatic LocalSyster
DHCP Client Manages n... Started Automatic LocalSyster
Distributed Link Tra... Sends notif... Started Automatic LocalSyster
Distributed Transac... Coordinate... Manual LocalSyster

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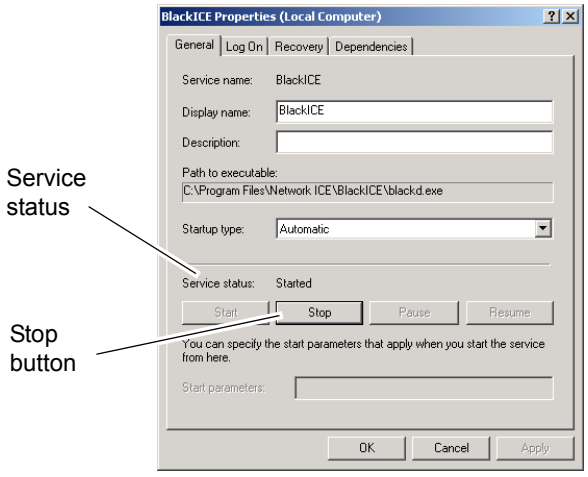
3. In the specific service (e.g. BlackICE) properties window, select *Stop*.



938A

4. Verify that the *Service status* reads *Stopped*.
5. Select *OK* and close all windows.
6. Repeat these instructions for all VPN, wireless network cards or any firewall protection programs running on your PC.

NOTE

If you are unsure of the firewall/networking services on your PC, contact your local IT administrator for details. Windows 2000 and XP PCs allow you to send a list of services to your IT administrator.

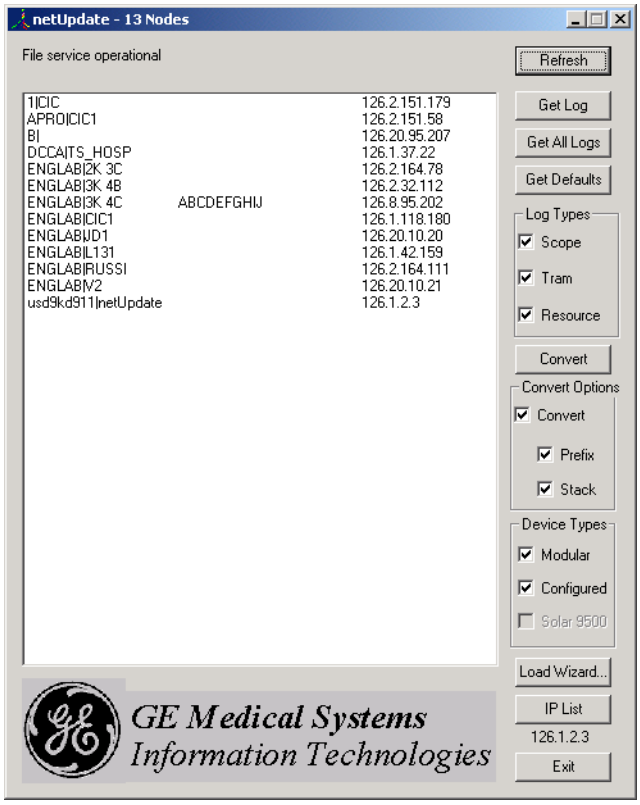
Set Up a Log Folder and Get Logs

NOTE

Use the *List* or *Details* view on your PC when starting the *netUpdate.exe* application. Do not use the *Thumbnail* view.

Always run the *netUpdate.exe* application from the CD-ROM directory. Do not run the application from any other directory.

1. Make sure the patient monitor is in monitoring mode.
2. Insert the CD-ROM into the CD-ROM drive.
3. Double-click *My Computer*.
4. Create a folder for the log files in the root directory. (e.g. C:\logs)
5. Return to *My Computer* and double-click the CD-ROM drive.
6. Select *dl* > *code* > *netUpdate.exe*.



939A

7. In the *netUpdate* window, select the patient monitor name or IP address from the device list. Click *Refresh* until the IP address or patient monitor name displays.
8. Click *Get Log* or *Get All Logs*.

NOTE

If you select *Get All Logs* and are connected to the Unity Network, logs from every device type selected will transfer.

9. Select the folder you created for log files, then click OK.
10. The log file displays and a message at the top of the netUpdate window displays a message that the log retrieval was successful.

Get Logs via CIC

Requirements

- Clinical Information Center (CIC) networked to the patient monitor(s)

Get Logs

1. At the CIC, select *View Other* > *Select Unit* > *Select Bed* to verify that the patient monitor(s) can be viewed.
2. From the CIC Main Menu, select *SETUP CIC*.
3. Select the *SERVICE PASSWORD* tab.
4. Type the password **mms_com** and press **Enter**.
5. At the command prompt, type **getlog -n "unit|device" -p "C:\filename"** (including quotes) where "unit|device" is the patient monitor name, and "C:\filename" is the CIC location you're copying to.

   Type **getlog /?** to display other options for error code generation.
6. Press **Enter**.

Get Logs via Centralscope

NOTE

The Unity Network software option must be enabled before the error logs may be transferred over the network to a Centralscope central station.

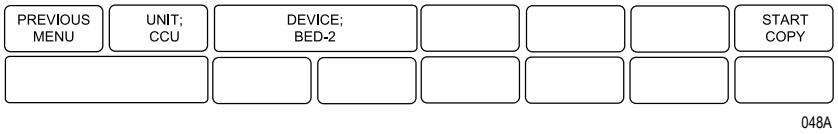
The following procedure describes how to copy the patient monitor and parameter module error logs and then transfer them to a diskette at the Centralscope central station.

CAUTION

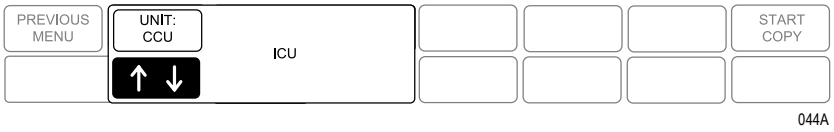
This procedure is intended for use by service personnel with advanced troubleshooting skills. Do not "experiment" with these commands! The consequences of misuse include loss of patient data, corruption of the central station operating software, or disruption of the entire Unity Network.

Access the *COPY LOGS* Menu

1. Beginning with the Centralscope central station Main Menu, select *CENTRAL SETUP* > *SERVICE*.
2. Enter password: **MEI CS 123**
3. Select *COPY LOGS*. The Copy Logs menu displays.
4. Select the Care Unit.

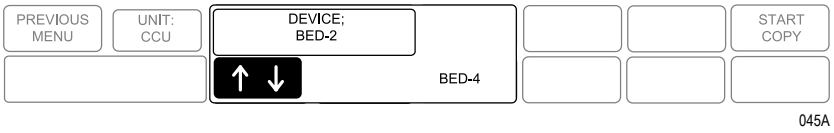


5. Select *UNIT:*
6. Using the **Trim Knob** control, change the displayed Care Unit name. When the desired Care Unit name displays, press the **Trim Knob** control.



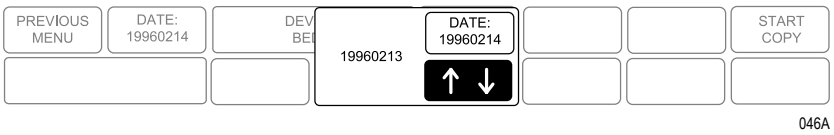
Select the Monitoring Device

1. Select *DEVICE:*
2. Using the **Trim Knob** control, change the displayed device name. Note that only monitoring devices within the previously selected Care Unit show. When the desired monitoring device name displays, press the **Trim Knob** control.



Select the Error Log Date

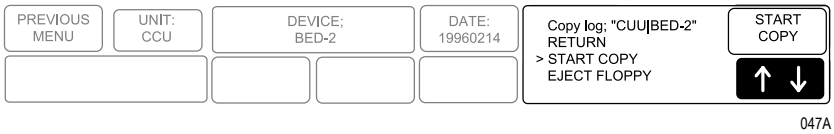
1. Select *DATE:*
2. Using the **Trim Knob** control, change the error log date. Note that one of the selections is *ALL*, which retrieves all stored error logs from the specified device. When the desired date displays, press the **Trim Knob** control.



Copy Error Logs

Once the Care Unit, device, and date have been specified the final step is to begin copying the error logs to the floppy diskette.

1. Insert a PC-formatted, high-density floppy diskette into the floppy diskette drive of the central station.
2. Select *START COPY.* A new display appears that confirms the file source device.
3. Using the **Trim Knob** control, select the desired function. Press the **Trim Knob** control to start.



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Once the copy function begins the Start Copy button changes to show the function: “copying.”

Eject Floppy

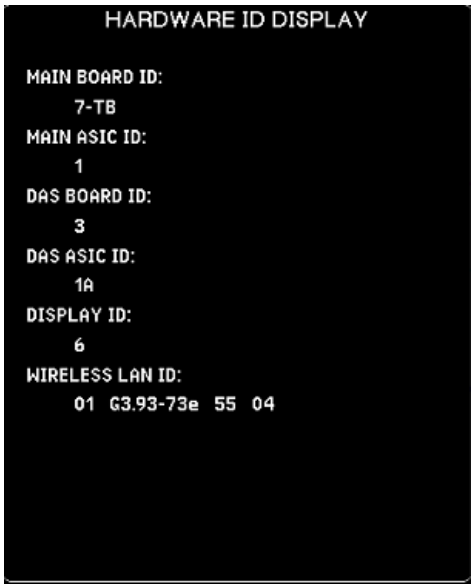
Select this option to eject the floppy diskette from the central station’s disk drive.

Wireless LAN

Many factors could cause the wireless patient monitor to exhibit some form of interruption in communication, such as loss of waveforms or delayed communication response. The solution may be as simple as enabling the wireless communication feature or as complex as analyzing the wireless and wired network. The purpose of this section is to help identify the source of the problem by using the wireless status indicator that is part of the monitor.

A patient monitor with the 802.11 wireless technology has a wireless status indicator in the *REVISION AND ID* Menu. For the 802.11b wireless patient monitor, there are two different wireless status indicators. One is located in the *REVISION AND ID* Menu and one in the Service Menu.

REVISION AND ID Menu



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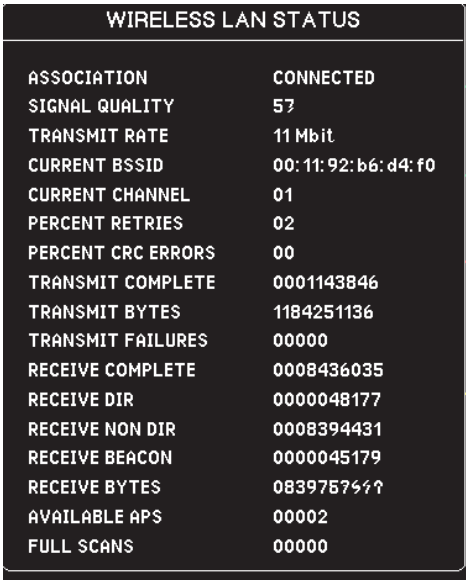
Service Menu



929A

Before troubleshooting, identify the wireless technology used in the patient monitor.

Access Service Mode

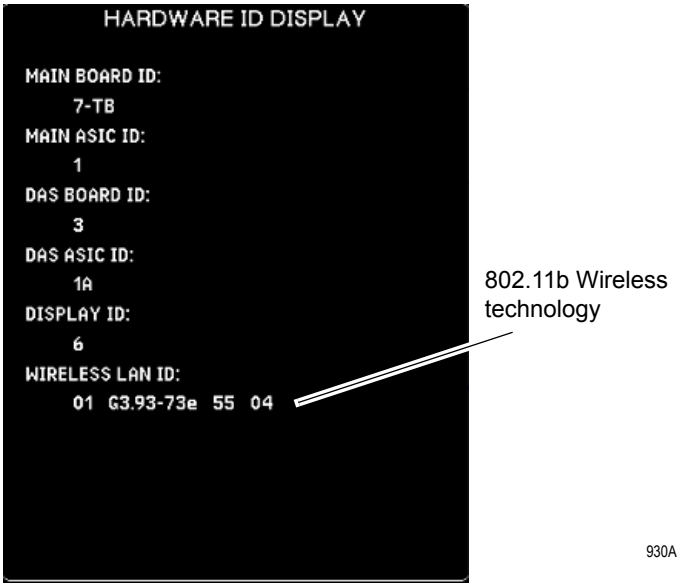
Access the Service Mode menu starting from the Main menu.

1. Select *MORE MENUS* > *MONITOR SETUP* > *SERVICE MODE*.
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407).

Identify the Wireless Technology

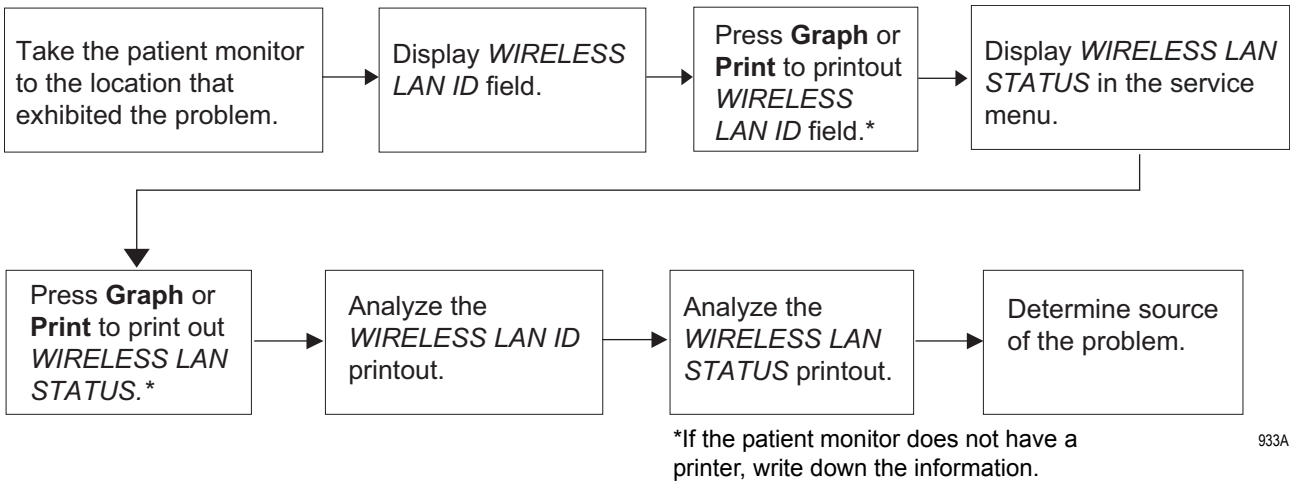
1. From the Monitor Setup Menu, select *REVISION AND ID*.
2. Select *NEXT* until the *HARDWARE ID DISPLAY* information window displays.
3. If the *WIRELESS LAN ID* field displays association status, driver version, signal quality status and transmit rate status (For example: 01 G3.93-73e 55 04), then your wireless card is 802.11b technology. Go to "802.11b" on page 6-26 for further troubleshooting.

   If the *WIRELESS LAN ID* field is missing, then the patient monitor either does not have wireless technology (hardware and software) installed or the wireless feature is not enabled. Go to "Confirm/ Configure Wireless LAN" on page 4-14 to enable the feature, then go to "802.11" on page 6-29 or "802.11b" on page 6-26 for further troubleshooting.



802.11b

Identifying the source of a wireless communication problem can be a challenge because of the dependencies between the patient monitor and the wireless/wired network. Below is a simplified troubleshooting process to determine where the problem originates. Following that are detailed steps to display status and analyze information.


Take the patient monitor to the location that exhibited the problem.
Display *WIRELESS LAN ID* field.
Press **Graph** or **Print** to printout *WIRELESS LAN ID* field.*
Display *WIRELESS LAN STATUS* in the service menu.
Press **Graph** or **Print** to print out *WIRELESS LAN STATUS.**
Analyze the *WIRELESS LAN ID* printout.
Analyze the *WIRELESS LAN STATUS* printout.
Determine source of the problem.
*If the patient monitor does not have a printer, write down the information.
933A

Analyze *WIRELESS LAN ID* Field

Display the *WIRELESS LAN ID* field as follows:

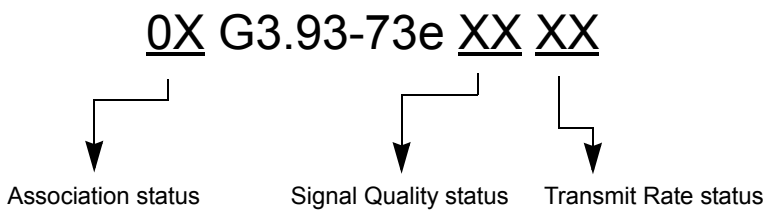
1. From the Monitor Setup Menu, select *REVISION AND ID*.
2. Select *NEXT* until the *HARDWARE ID DISPLAY* information window displays.

NOTE

If the *WIRELESS LAN ID* field does NOT display a status code as shown below, then wireless technology is not used or not enabled. See "Confirm/Configure Wireless LAN" on page 4-14 to enable the wireless feature.

The *WIRELESS LAN ID* field does not refresh. You must exit and re-enter the menu.

For proper operation of the 802.11b wireless patient monitor, analyze the association, signal quality and transmit rate status.



The following table defines all possible status values.

Status	Description
Association Status	
00	Dash is not connected wirelessly
0B	SSID/PASS KEY incorrect
0C	Wireless card firmware to request wireless card to reset
01	Dash connected to network
02	Wireless Dash disconnected
03	Wireless Dash roaming
04	Access point radio MAC scan
05	TKIP set has changes. Next TKIP can be computed
06	Next TKIP can be loaded
Signal Quality Status[1]	
Less than 4	No signal
5 → 8	Very low
9 → 4	Low
15 → 20	Good
21 → 26	Very good
27 and greater	Excellent
Transmit Rate Status	
01	1 Mbps
02	2 Mbps
04	5.5 Mbps
08	11 Mbps

1. Signal quality status is not a calibrated SNR (signal/noise ratio) value.

These values should be:

Association Status	01
Signal Quality Status	greater than 20
Transmit Rate Status	04 or greater

If the association status is other than 01, it is likely 0B (SSID/PASS KEY incorrect). Verify that the SSID and PASS KEY matches the access point configuration. Go to "Confirm/Configure Wireless LAN" on page 4-14 for steps to check the settings.

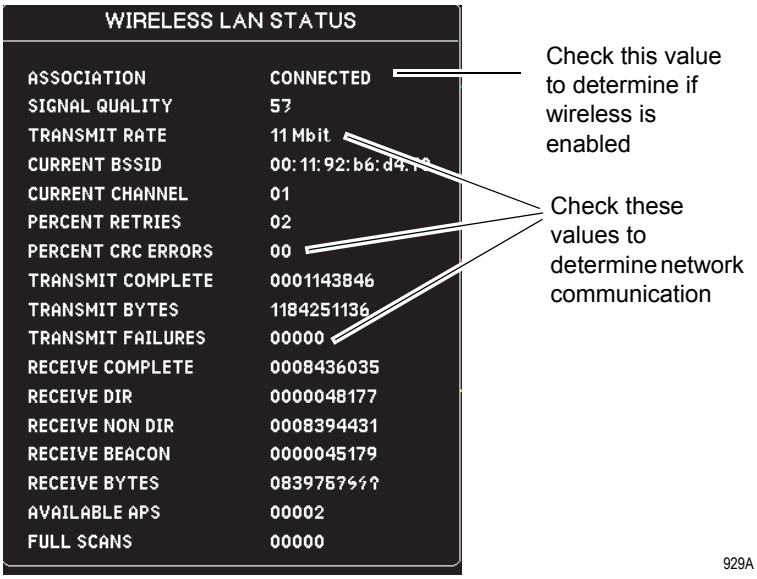
If signal quality and transmit rate statuses are less than the above values, the source of the problem is likely the wireless network (access point). Go to Analyze *WIRELESS LAN STATUS* Screen below and contact your local hospital IT department for further troubleshooting.

If association status, signal quality and transmit statuses meet the requirements, then the wireless patient monitor is not the source of the problem. Contact your local hospital IT department for further troubleshooting.

Analyze *WIRELESS LAN STATUS* Screen

Display the *WIRELESS LAN STATUS* screen by entering Service Mode (see "Access Service Mode" on page 6-24) and selecting *MONITOR SETTINGS* > *WIRELESS LAN STATUS*.

The *WIRELESS LAN STATUS* screen displays the same information as the *WIRELESS LAN ID* field along with advanced status fields. Personnel with specialized training (hospital IT or network engineer) can interpret this information.



1. Check that the information updates every 4 seconds indicating communication.
2. Check for the following status information:

ASSOCIATION	*CONNECTED*
TRANSMIT RATE	Greater than 5.5 Mbit
PERCENT CRC ERRORS	*00*
TRANSMIT FAILURES	*00000*

3. If the *ASSOCIATION* status in the *WIRELESS LAN STATUS* window is other than *CONNECTED*, see "Confirm/Configure Wireless LAN" on page 4-14 to check if the wireless feature is enabled.

Contact GE Technical Support for additional assistance.

802.11

Country Code Mismatched

The patient monitor is configured with international roaming. The country abbreviation code (US 02 V4.63 00022) must match the country the patient monitor is in. If the code does not match:

1. Check to make sure the correct Access Point is installed.
2. Refer to the wireless LAN (Symbol Access Point) Installation and Service Manual for details on proper Access Point installation.

SSID Incorrect

The most common cause of non-communication is an incorrect SSID. If the communication status in the *WIRELESS LAN ID* is 01 (US 01 V4.63 00022), the wireless card is not communicating with the Access Point. The SSID must match the Access Point's NET ID. To change the SSID status access the Service Mode menu starting from the Main menu:

1. Enter Service Mode (see "Access Service Mode" on page 6-24) and select *MONITOR SETTINGS* > *CONFIGURE WIRELESS LAN*.
2. Select *MONITOR SETTINGS* > *CONFIGURE WIRELESS LAN*.
3. Select *SSID*.
4. For all standard installations, the SSID should be GEMS (default).

Check Network Communication

If the communication status is 02, the wireless card is communicating with the Access Point and the network should be available.

1. Check the network connection to the Access Point.
2. Refer to the wireless LAN (Symbol Access Point) Installation and Service Manual for details on proper Access Point installation.

Intermittent communication may be caused if the patient monitor is out of range or there is RF interference.

- If the patient monitor is out of range, add additional Access Points to extend the coverage area.
- If there is RF interference, the source of the interference must be removed or shielded.

If all communication checks out, replace the wireless card. Go to the Field Replaceable Units chapter for information.

7 Field Replaceable Units

Ordering Parts

The parts lists and drawings in this chapter supply enough detail for you to order parts for the assemblies considered field replaceable.

If you require additional information or troubleshooting assistance, contact GE Technical Support.

To order parts, contact Service Parts at the address or telephone number listed on the “How to Reach Us...” page found in the front of this manual.

For the latest parts information, including substitutions, obsolescence and compatibility, please visit our Parts ID Portal website at: egems.gemedicalsystems.com/partsiduser/gems/Welcome.jsp

Parts

The table below lists field replaceable units that can be ordered.

NOTE

Due to recent branding changes, the part ordered may vary slightly in appearance from the previous part. Performance is not affected. Check the Parts ID Portal website link (see previous page) for a full list of available parts.

Part Number	Description	Dash 3000	Dash 4000	Dash 5000
Handle Assemblies - See "Remove/Replace Handle Assembly" on page 7-9 for disassembly.				
2026653-013	DASH HANDLE WITHOUT ALARM WITH WIRELESS LAN ■ Includes assembled handle, antennas and hardware.	X	X	X
2026653-014	DASH HANDLE WITH ALARM WITH WIRELESS LAN ■ Includes assembled handle, antennas and hardware.	X		
Display Assemblies - See "Remove/Replace Display Assembly" on page 7-12 for disassembly.				
2026653-002	DASH 5K NEC DISPLAY ASSEMBLY ■ Includes complete display assembly, flex, labels and hardware for Dash 5000 patient monitor. **NOTE:** V6 software or later required.			X
2026653-003	DASH 5K NEC DISPLAY ASSEMBLY WITHOUT LCD ■ Includes display components, flex assembly, labels and hardware for Dash 5000 patient monitor. (no LCD) **NOTE:** V6 software or later required.			X
2026653-004	DASH 4K DISPLAY ASSEMBLY ■ Includes complete display assembly, flex, labels and hardware for Dash 4000 patient monitor.		X	
2026653-005	DASH 4K DISPLAY ASSY WITHOUT LCD ■ Includes display components, flex assembly, labels and hardware for Dash 4000 patient monitor. (no LCD) **NOTE:** This kit is for a Sharp display only.		X	
2026653-006	DASH 3K DISPLAY ASSEMBLY ■ Includes complete display assembly (including flex and inverter) and labels for Dash 3000 patient monitor.	X		
2026653-007	See "Replace Display Assembly Parts" on page 7-20 for disassembly. DASH 3K DISPLAY ASSEMBLY WITHOUT LCD ■ Includes display components and labels for Dash 3000 patient monitor. (no LCD)	X		

Part Number	Description	Dash 3000	Dash 4000	Dash 5000
Display Flex Assembly - See "Replace Display Flex Assembly" on page 7-18 for disassembly.				
2013114-026	DASH 4K(SHARP)/5K DISPLAY FLEX ■ Includes complete display flex for Dash 4000 (Sharp display)/5000 patient monitors.		X	X
Alarm Light Assemblies - See "Replace Display Assembly Parts" on page 7-20 for disassembly.				
2026653-025	DASH 4K ALARM LIGHT ASSEMBLY ■ Includes alarm light, cable, lens and lens blank for 10" Dash 4000 patient monitor.		X	
2026653-026	DASH 5K ALARM LIGHT ASSEMBLY ■ Includes alarm light, cable, lens and lens blank for 12" Dash 5000 patient monitor.			X
Inverter Assemblies - See "Replace Display Assembly Parts" on page 7-20 for disassembly.				
2026653-022	DASH 3K DISPLAY INVERTER ■ Includes display inverter and cable for Dash 3000 patient monitor.	X		
2021926-005	DASH 4K/5K DISPLAY INVERTER ■ Includes display inverter and cable for Dash 4000/ 5000 patient monitor.		X	X
Keypad/Trim Knob Assemblies - See "Replace Display Assembly Parts" on page 7-20 for disassembly.				
2026653-016	DASH 3K KEYPAD ASSEMBLY ■ Includes keypad assembly with encoder and hardware for Dash 3000 patient monitor.	X		
2026653-017	DASH 4K KEYPAD ASSEMBLY ■ Includes keypad assembly with encoder and hardware for Dash 4000 patient monitor.		X	
2026653-018	DASH 5K KEYPAD ASSEMBLY ■ Includes keypad assembly with encoder and hardware for Dash 5000 patient monitor.			X
2026653-024	DASH3K/4K/5K TRIM KNOB ■ Includes Trim Knobs and clip.	X	X	X

Part Number	Description	Dash 3000	Dash 4000	Dash 5000
DAS Assemblies - See "Replace Main Unit Parts" on page 7-27 for disassembly.				
2026653-008	DASH Generic OHMEDA DAS ■ Includes Generic Ohmeda DAS assembly, labels and hardware. **NOTE:** V2B software or later required with DAS V5.	X	X	X
2026653-009	DASH MASIMO DAS ■ Includes Masimo DAS assembly, labels and hardware. **NOTE:** V5 software or later required.	X	X	X
2026653-010	DASH NELLCOR-OXIMAX DAS ■ Includes Nellcor OxiMax DAS assembly, labels and hardware. **NOTE:** V5.4 software or later required.	X	X	X
Wireless LAN Assemblies - Replacement instructions ship with the FRU kit.				
2026653-011	DASH WLAN PCMCIA 802.11 ■ Includes PCMCIA wireless card, connectors, hardware and labels for 802.11. (no antennas)	X	X	X
2026653-012	DASH WLAN COMPACT FLASH 802.11B ■ Includes compact flash wireless card with adapter, connectors, hardware and labels for 802.11b. (no antennas) **NOTE:** V5.4 software or later required.	X	X	X
NBP Pump Assembly - See "Replace Main Unit Parts" on page 7-27 for disassembly.				
2013114-020	DASH NBP PUMP ASSEMBLY ■ Includes NBP assembly and hardware.	X	X	X
Writer Assembly/Flex - See "Replace Main Unit Parts" on page 7-27 for disassembly.				
2026653-015	DASH WRITER FLEX ■ Includes writer flex and hardware.	X	X	X
2026653-021	WRITER 50MM CS2 ■ Includes light gray writer with captive hardware.	X	X	X
Speaker Assembly - See "Replace Main Unit Parts" on page 7-27 for disassembly.				
2013114-017	DASH SPEAKER ASSEMBLY ■ Includes speaker assembly and hardware.	X	X	X
CPU/Battery Housing Assembly - See "Replace Main Unit Parts" on page 7-27 for disassembly.				
2013114-028	DASH CPU WITH BATTERY HOUSING WITH WIRELESS LAN ■ Includes CPU/battery housing assembly, PCMCIA card retaining plate and hardware. **NOTE:** V 5.3 or later software required.	X	X	X

Part Number	Description	Dash 3000	Dash 4000	Dash 5000
Power Supply Assembly - See "Replace Main Unit Parts" on page 7-27 for disassembly.				
2013114-018	DASH POWER SUPPLY ■ Includes power supply assembly and hardware.	X	X	X
Battery Door Assembly - See "Replace Battery Door" on page 7-39 for disassembly.				
2026653-019	DASH BATTERY DOOR ■ Includes frame, fasteners and silicone doors.	X	X	X
Foot/Writer Cover Assemblies - See "Replace Battery Door" on page 7-39 or "Replace Foot" on page 7-40 for disassembly.				
2026653-020	DASH FOOT AND WRITER COVER ■ Includes dark blue foot, light gray writer cover and hardware.	X	X	X
Batteries				
2017857-002	RECHARGEABLE 11.1V BATTERY	X	X	X
Hardware and Labels				
2013114-029	HARDWARE KIT	X	X	
Labels				
2026653-027	DASH 3K/4K/5K SIDE LABELS ■ Includes all languages	X	X	X
2026653-028	DASH 5K FRONT LABELS ■ Includes all languages			X
2026653-029	DASH 4K FRONT/DAS LABELS ■ Includes all languages		X	
2026653-030	DASH 3K FRONT/DAS LABELS ■ Includes all languages	X		

Disassembly Guidelines

WARNINGS

REPAIR TO THE FRU LEVEL — Field repairs are recommended to the field replaceable unit (FRU) only. Attempting a field repair on a PCB or a factory sealed component or assembly could jeopardize the safe and effective operation of the patient monitor.

DAS ASSEMBLY — Do NOT open the DAS assembly as this breaks the isolation barrier which may result in patient death or serious injury. The DAS assembly is a field replaceable unit only. There are NO field repairs or adjustments for the DAS assembly.

BATTERY EXPLOSION HAZARD — When removing the GCX plate and the footpad from the bottom of the patient monitor, clearly identify the screws to ensure the same screws are used to replace both the footpad and the GCX plate. Do NOT re-assemble the footpad without the GCX plate. Screws that are too long will penetrate into the battery case and cause the battery to leak or to explode.

NOTE

GE recommends that you assemble the patient monitor using the NEW fasteners (screws, washers, etc.) provided in the FRU Kits. Some fasteners, like the screws with a thread locking coating, are NOT intended to be re-used more than three times.

Tools Required

A standard set of hand tools is required for disassembly and assembly.

Before Disassembly

Before you disassemble the patient monitor, you should ALWAYS do the following tasks.

1. Remove AC power.
2. Remove both batteries.
3. Provide appropriate electrostatic discharge protection to prevent damaging the patient monitor.
4. Be aware that the nonspecific disassembly instructions apply to all patient monitors supported by this service manual. Disassembly for specific models of the patient monitor are identified when required.

Hardware Precautions

When disassembling the patient monitor, observe the following guidelines:

- Remove the handle assembly, then remove the display assembly to access the field replaceable units of the display assembly and the main unit.
- Note the positions of wires, cables, and different sized screws; marking them if necessary to ensure they are replaced correctly.
- DO NOT kink, pinch, stretch, twist, or tightly fold a flex cable.
- Unless otherwise stated, reassemble the patient monitor in reverse order of disassembly.

Electrostatic Discharge (ESD) Precautions

All external connector inputs and outputs of the patient monitor are designed with protection from ESD damage. However, if the patient monitor requires service, exposed components and assemblies contained within are susceptible to ESD damage. This includes human hands, non-ESD protected work stations and/or improperly grounded test equipment.

The following guidelines help make a service workstation more resistant to the ESD damage:

- Discharge any static charge you may have built up before handling semiconductors or assemblies containing semiconductors.
- A grounded, antistatic wristband (3M part number 2046 or equivalent) or heel strap should be worn *at all times* while handling or repairing assemblies containing semiconductors.
- Use properly grounded soldering and test equipment.
- Use a static-free work surface (3M part number 8210 or equivalent) while handling or working on assemblies containing semiconductors.
- DO NOT remove semiconductors or assemblies containing semiconductors from antistatic containers (Velo-stat bags) until absolutely necessary.
- Make sure power to an assembly is turned off before removing or inserting a semiconductor.
- DO NOT slide semiconductors or electrical/electronic assemblies across any surface.
- DO NOT touch semiconductor leads unless absolutely necessary.
- Semiconductors and electrical/electronic assemblies should be stored only in antistatic bags or boxes.
- Handle all PCB assemblies by their edges.
- DO NOT flex or twist the circuit board.

These guidelines may not guaranty a 100% static-free workstation, but can greatly reduce the potential for failure of any electrical/electronic assemblies being serviced.

Remove/Replace Handle Assembly

1. Remove the two screws holding the handle to the patient monitor. Take care not to strain the cables if your patient monitor has the alarm light option or the wireless option.

537A

2. If your patient monitor does NOT have the wireless option, replace the defective handle assembly or continue to "Remove/Replace Display Assembly" on page 7-12 to replace other parts.

   If your patient monitor has the wireless option, connect the antenna as follows.

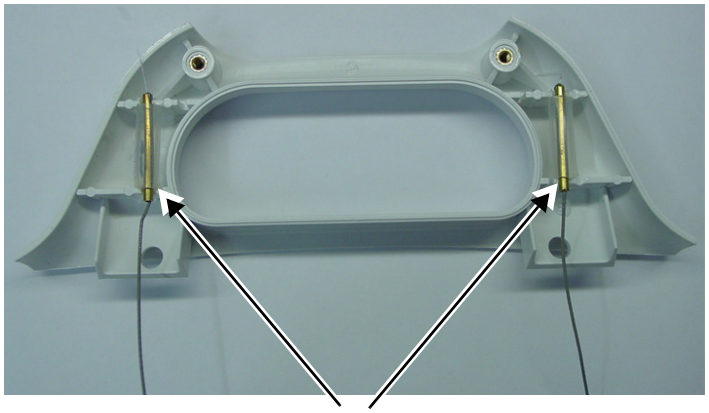
   a. Disassemble the new handle assembly by removing two screws.

   NOTE

   There may be one or two antennas depending on the wireless technology in your patient monitor. Handle the antennas and connectors carefully as they can easily be damaged.

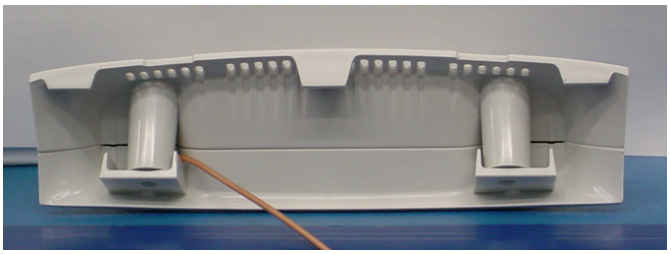
   b. Install the tubing on the wireless antenna(s).

   c. Install the antenna(s) into the plastic grooves.



936A

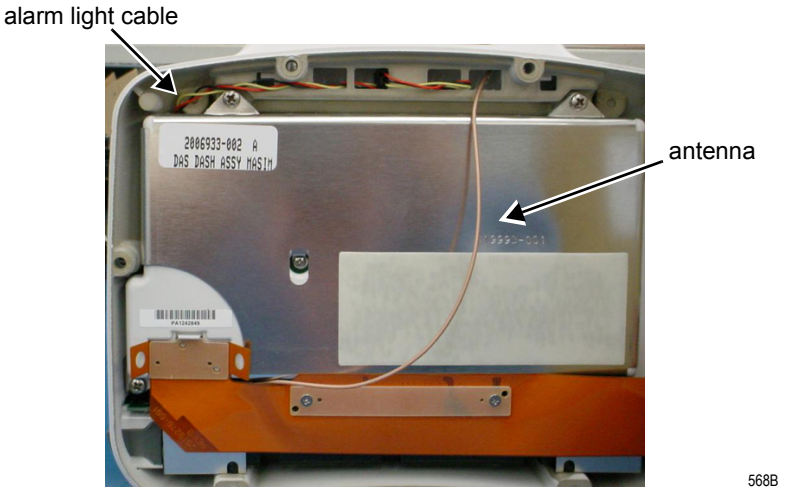
d. Reassemble the handle with the two screws. Route antenna (and alarm light cable, if present) out the bottom of the handle as shown so antenna is not pinched between the handle halves.



565C

e. Remove the display assembly. Refer to "Remove/Replace Display Assembly" on page 7-12.

f. Route antenna (and alarm light cable, if present) into the patient monitor's housing as shown.

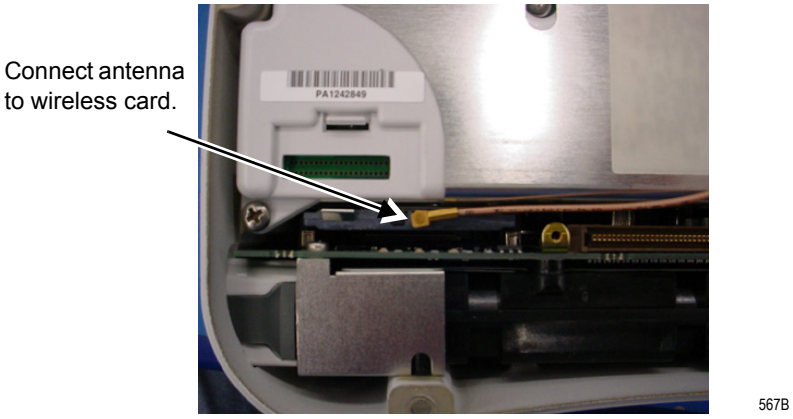


568B

NOTE

If the new handle assembly has an alarm light, the DAS assembly must be removed to connect the cable to J1 on the writer board. Refer to "Replace DAS Assembly" on page 7-27 for instructions on removing and reinstalling the DAS assembly.

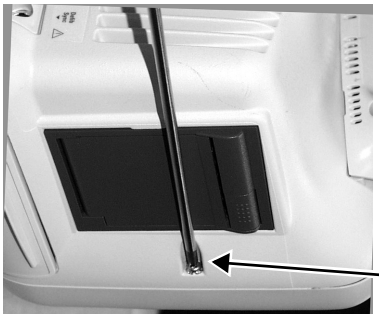
g. Use a needle nose pliers to snap the coax connector of the antenna into the wireless card. Route coax per the picture.



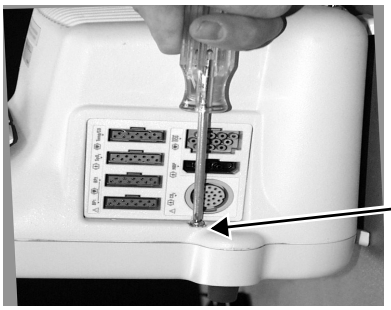
h. Reinstall the display assembly.

Remove/Replace Display Assembly

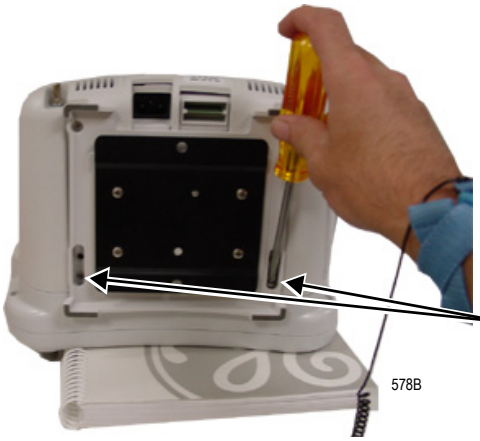
1. Remove the handle assembly from the patient monitor. Refer to "Remove/Replace Handle Assembly" on page 7-9.
2. Place the patient monitor face down on a non-abrasive, static-free surface. Make sure the **Trim Knob** control hangs off the edge of the surface to avoid damage.
3. Use a Phillips head screw driver to remove the four screws (six screws for Dash 5000 patient monitors) holding the display assembly to the main unit.



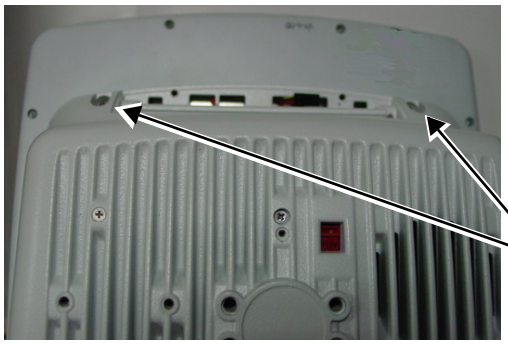
579A



580A


Note: Use a screwdriver with a long blade or remove the GCX plate first for easy access to the bottom screws.
...and the two shorter screws from the bottom of the unit.

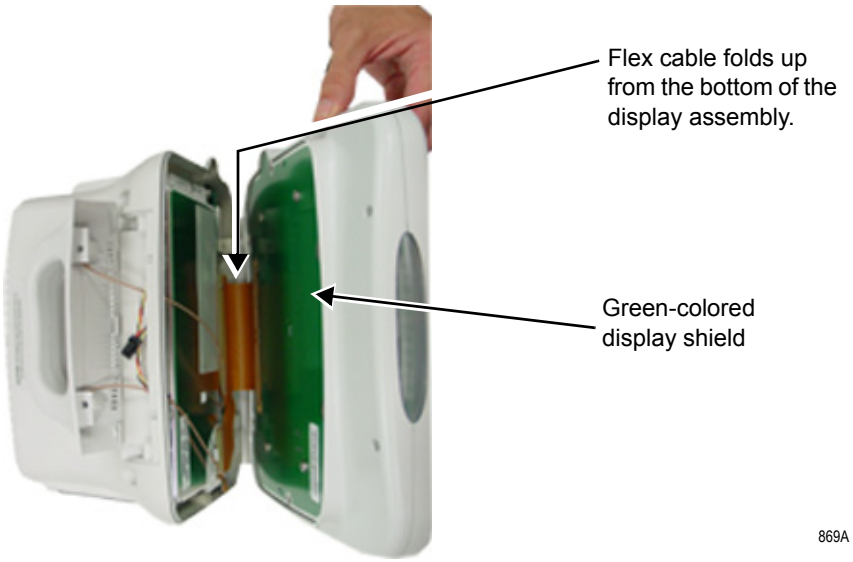
578B

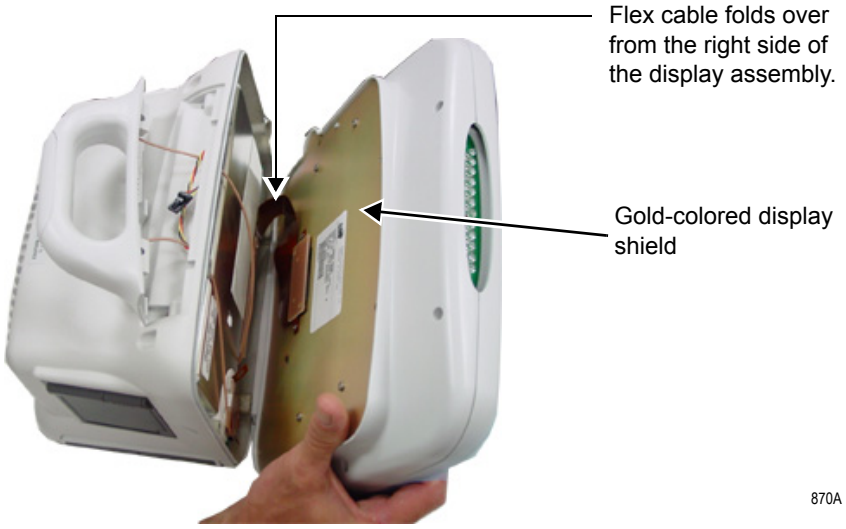


4. Partially separate the display assembly from the main unit and look inside the unit to determine how the display flex cable is folded. Depending on the model, the Dash patient monitor may have a display flex cable that folds up from the bottom or from the right side of the display.

   The location of the fold dictates how to position the display assembly to remove it from the main unit.

CAUTION
CABLE DAMAGE — Do not kink, pinch, stretch, twist, or tightly fold the display flex cable. If you do not handle the flex cable gently, you will damage the cable.





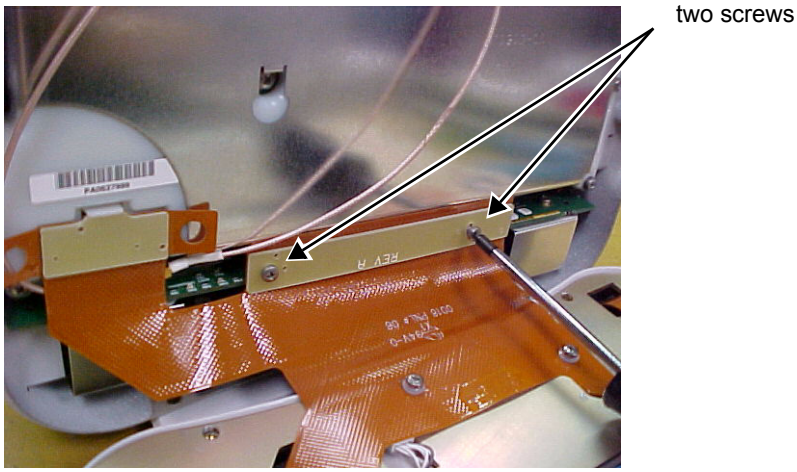
5. To prevent damaging the display flex cable, position the display assembly for the patient monitor you are servicing.

Display assembly with green-colored display shield

Display assembly with gold-colored display shield

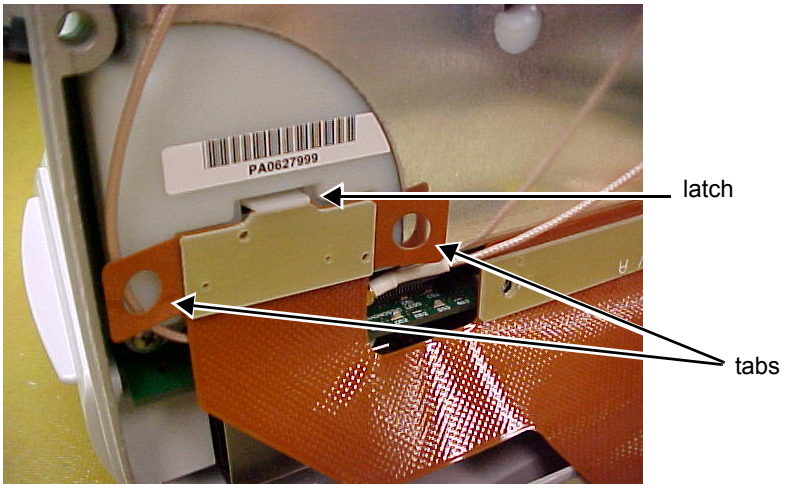
871A

6. Remove the two screws attaching the flex circuit to the main unit's CPU/battery housing assembly. Remove the flex connector by pulling on the flex connector strain relief.



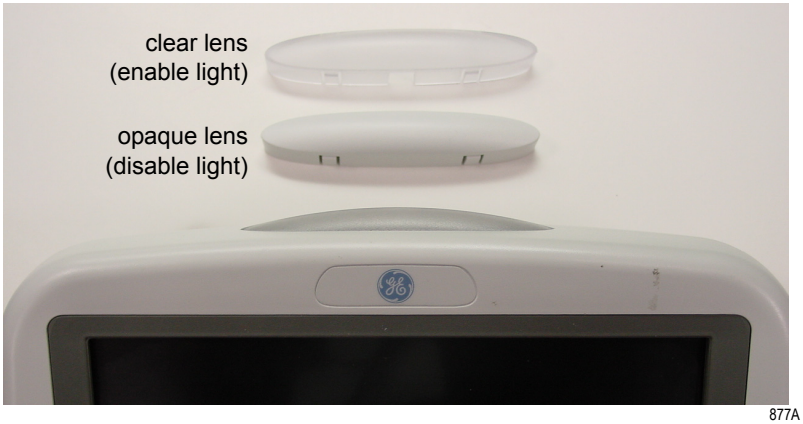
543A

7. Remove the DAS connector by lifting the snap latch and tabs.

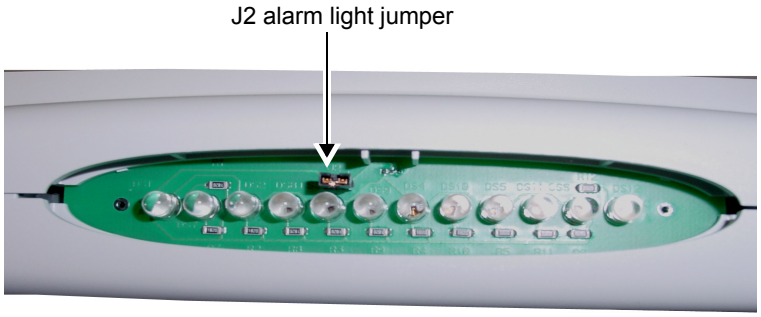


544A

8. Place the display assembly face down on a non-static, non-abrasive surface. Make sure the **Trim Knob** control hangs off the edge of the surface to avoid damage.
9. Replace the defective display assembly.
10. To replace the Display Flex assembly, refer to "Replace Display Flex Assembly" on page 7-18.
11. To replace parts in the main unit, refer to "Replace Main Unit Parts" on page 7-27.
12. Refer to the figure below to determine if you need to enable or disable the alarm light on your Dash display assembly.



877A

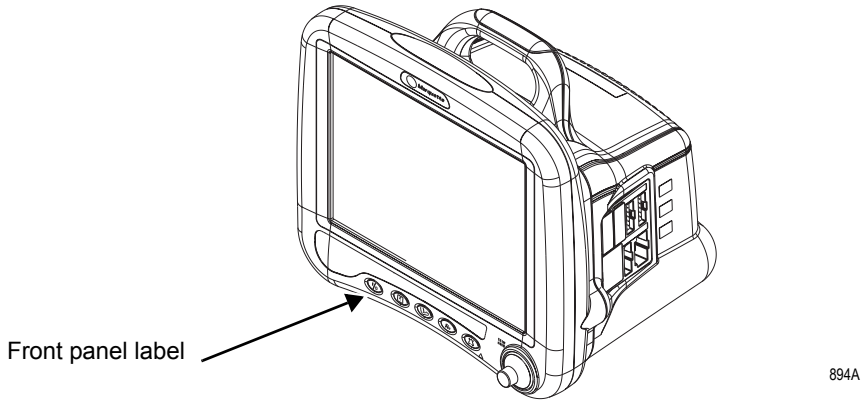


878A

a. To enable the alarm light option, verify the alarm light jumper is connected to both J2 pins on the alarm light PCB.

b. To disable the alarm light option, remove the jumper from the alarm light PCB, or connect the jumper to only one of the J2 pins on the alarm light PCB.

13. Connect the display assembly to the main unit.
14. Refer page 7-12 and re-assemble the patient monitor in reverse order.
15. Apply the Dash front panel label as shown below.



16. Complete the procedures in "Recommended Checkout" on page 7-42.

Replace Display Flex Assembly

Dash 3000 Display/Flex Assembly

The Dash 3000 display assembly includes the flex assembly.

1. Remove the handle and display assemblies according to steps starting on page 7-9.
2. Replace the display assembly and reassemble the patient monitor in reverse order of disassembly.

Dash 4000 Sharp and 5000 Display Flex Assembly

CAUTION
FLEX CABLE DAMAGE — DO NOT kink, pinch, stretch, twist, or tightly fold a flex cable.

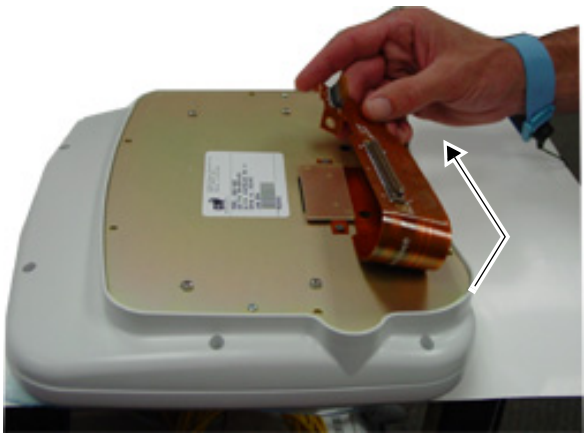
1. Remove the handle assembly. Refer to page 7-9.
2. Remove the display assembly from the main unit. Refer to page 7-12.

   NOTE
   Use a thick book or some heavy object to support the display assembly while you attach the display flex to the main unit.

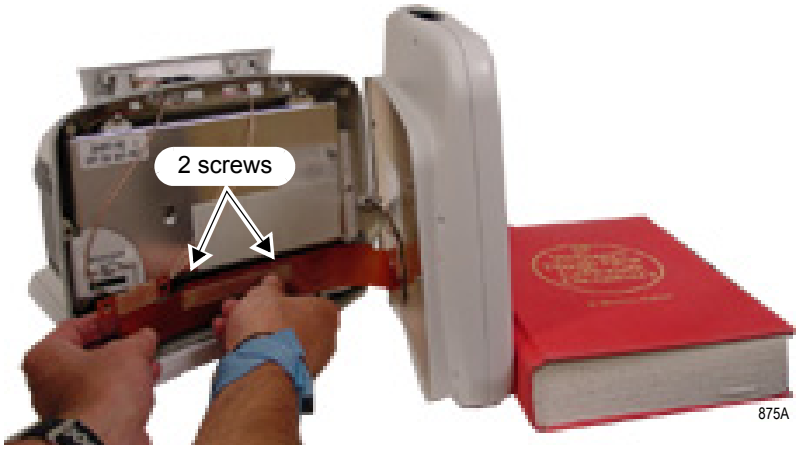
3. Disconnect the flex cable from the display.
4. Insert the new flex cable connector into the display connector as shown in the figure below.

5. Using two flathead screws from the kit, secure the flex cable to the display assembly.

6. Carefully bend the display flex as shown.

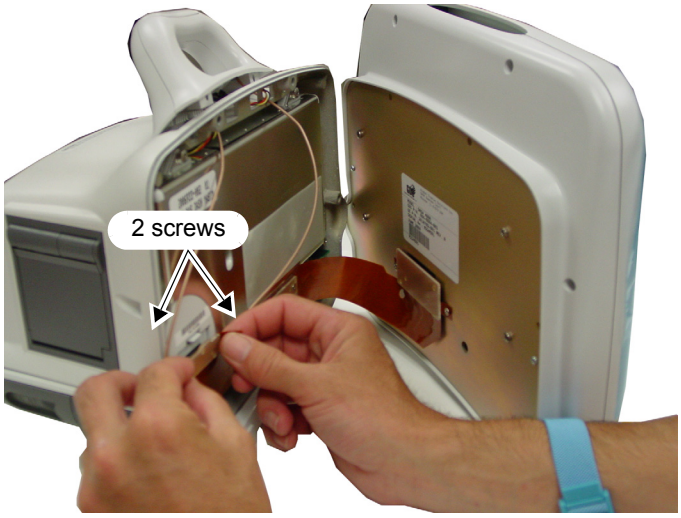

874A

7. Pick up and support the display assembly between the main unit and a thick book.
8. Use two flathead screws from the kit to carefully secure the flex processor cable connector to the main processor PCB.



875A

9. Carefully align and insert the DAS cable pins into the DAS assembly until the snap latch clicks into place.



876A

10. Reassemble the patient monitor in reverse order of disassembly.
11. Complete the procedures in "Recommended Checkout" on page 7-42.

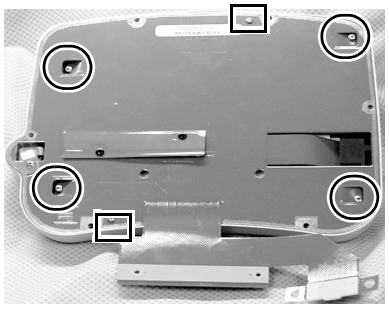
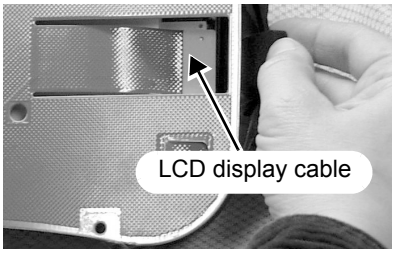
Replace Display Assembly Parts

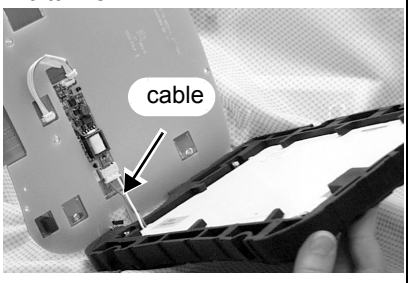
Use the following procedures to replace the display assembly parts:

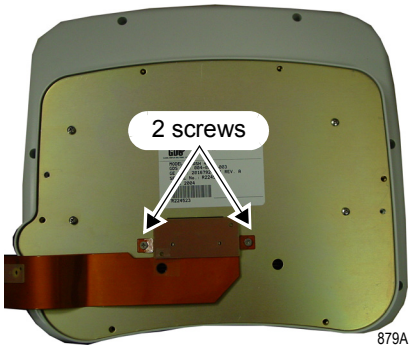
1. "Remove/Replace Handle Assembly" on page 7-9.
2. "Remove/Replace Display Assembly" on page 7-12.
3. "Open Display Assembly" on page 7-21.
4. On the following pages find the steps for the part and Dash model you are servicing:
   - "Replace Dash 4000/5000 Alarm Light" on page 7-22.
   - "Replace Display Inverter" on page 7-23
   - "Replace Key Pad Assembly or Trim Knob Control" on page 7-24
   - "Replace Display Assembly Without LCD" on page 7-25

Open Display Assembly

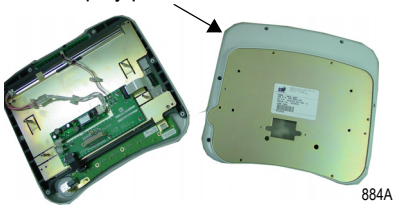
Follow the steps below for the patient monitor you are servicing.

<table>
<tr><th>Dash 3000 patient monitor
with display shield flex circuit</th><th>Dash 4000 Sharp or 5000 patient
monitor with display assembly</th></tr>
<tr><td>
Separate the patient monitor bezel from the LCD display.
1. Remove four screws holding the display shield to the LCD display and two screws holding the display shield to the patient monitor bezel.
four larger screws
two smaller screws

500A
2. Remove the display assembly from the patient monitor bezel.
3. Pull the LCD display isolator out of the way. Disconnect the LCD display cable.


501A
4. Disconnect the cable from the backlight inverter PCB.


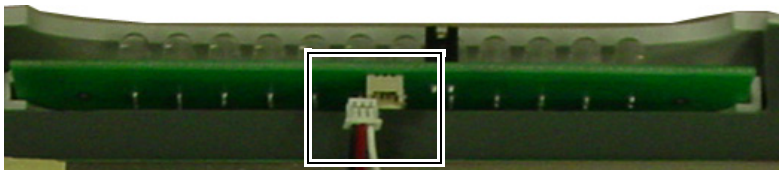
502A
</td><td>
Separate the transition bezel from the front bezel.
1. Remove the two screws from the display flex cable. Pull up on the latch taps to remove the flex cable from the display.


879A
2. Remove the six screws from the back of the transition bezel and the four screws from the back of the metal display plate.
six screws
four screws

880A
3. Separate the transition bezel from the front bezel.
4. Set aside the transition bezel and the metal display plate.

884A
</td></tr>
</table>

Replace Dash 4000/5000 Alarm Light

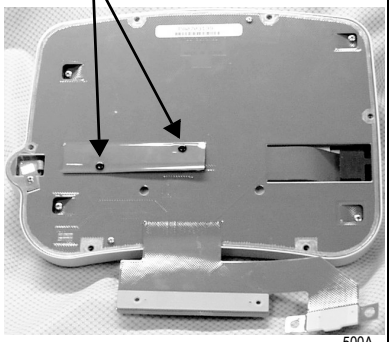
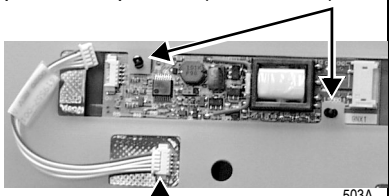
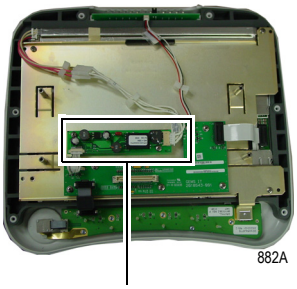
1. Remove the handle assembly. Refer to page 7-9.
2. Remove the display assembly from the main unit. Refer to page 7-12.
3. Open the display assembly. Refer to page 7-21.
4. Remove the clear alarm light lens.
5. Disconnect the alarm light cable from the alarm light PCB.


888A

6. Remove the defective alarm light PCB and set aside.
7. Insert the new alarm light PCB and connect the alarm light cable to the alarm light PCB connector.
8. Verify the alarm light jumper is secured to both J2 pins. Refer to step 12 on page 7-16.
9. Re-assemble the patient monitor in reverse order.
10. Complete the procedures in "Recommended Checkout" on page 7-42.

Replace Display Inverter

Following steps below for the patient monitor you are servicing.

Dash 3000 patient monitor with display shield flex circuit	Dash 4000 Sharp and 5000 patient monitor with display assembly
1. Flip over the display shield flex circuit. Remove the male end of the two snap rivets. plastic snap rivets (male end)  500A 2. Flip over the display shield flex circuit. Disconnect the display shield cable from the backlight inverter PCB. plastic snap rivets (female end)  503A display shield cable 3. Use a screw driver to remove the female end of the two snap rivets. Do not re-use these rivets.	1. Open the display assembly. Refer to page 7-21. 2. Disconnect the cable connectors from the backlight inverter PCB compression fittings.  882A 881A 3. Remove the two screws anchoring the backlight inverter PCB to the display mounting plate. 881A

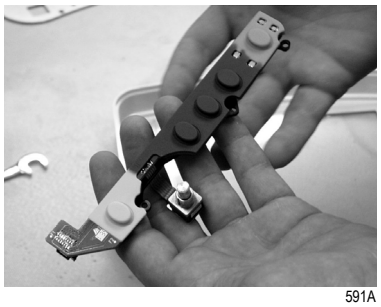
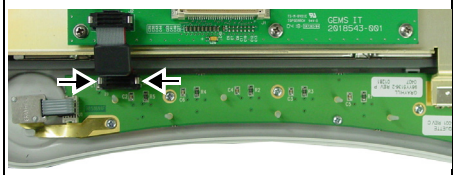
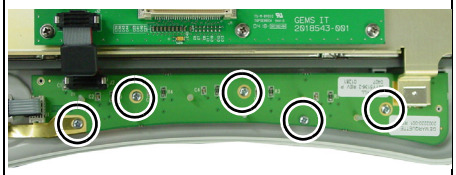
11. Replace the backlight inverter PCB.
12. Reassemble the display assembly in reverse order.
13. Complete the procedures in "Recommended Checkout" on page 7-42.

Replace Key Pad Assembly or Trim Knob Control

Following steps below for the patient monitor you are servicing.

<table>
<tr><th>Dash 3000 patient monitor
with display shield flex circuit</th><th>Dash 4000 Sharp patient monitor with
display assembly</th></tr>
<tr><td colspan="2">1. Remove the rubber knob from the Trim Knob control shaft.
2. Use an 11mm wrench or nut driver to remove the nut holding the Trim Knob control's shaft to the display bezel.

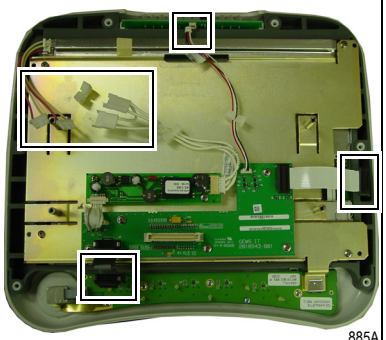
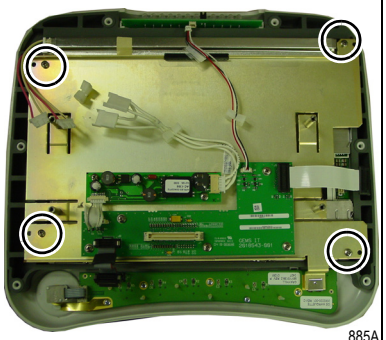
589A
3. Open the display assembly. Refer to page 7-21.</td></tr>
<tr><td>4. Remove the three screws holding the key pad assembly to the display bezel.

three screws
590A
 
591A
Keypad Assembly</td><td>4. Remove the keypad assembly from the front bezel.
a. Gently squeeze the latch release and pull up to disconnect the keypad cable from the keypad PCB.
 
883A
b. Remove the four screws anchoring the mounting plate to the LCD display. Refer to steps 4b and 4c on page 7-25.
c. Remove the five screws holding the key pad assembly to the front bezel.
 
883A</td></tr>
</table>

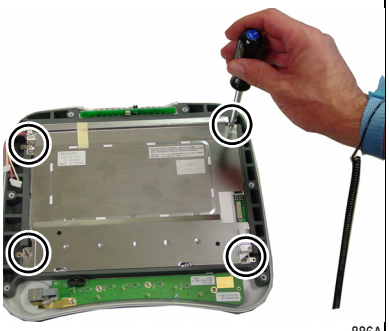
4. Place the new key pad assembly in the display bezel. Make sure the washer tab fits in the retaining slot of the **Trim Knob** control's shaft and replace the 11mm nut.
5. Secure the new key pad with the screws.
6. Reassemble the display assembly in reverse order.
7. Complete the procedures in "Recommended Checkout" on page 7-42.

Replace Display Assembly Without LCD

1. Open the display assembly. Refer to page 7-21.
2. Remove the LCD display. Follow the steps for the patient monitor you are servicing.

Dash 3000 patient monitor with display shield flex circuit	Dash 4000 Sharp and 5000 patient monitor with display assembly
a. Peel back and remove the rubber display isolator from around the display. 504A b. Go to next step.	a. Disconnect the five cable connectors.  885A b. Remove the four screws anchoring the mounting plate to the LCD display.  885A c. Remove the mounting plate and set aside.

d. Use a 5 mm nut driver to remove the four stand-off screws anchoring the display to the rubber display isolator.



886A

e. Lift out the LCD display from the rubber display isolator and set aside.

887A

3. Dampen a clean, soft cloth with window cleaner and carefully clean and dry the new LCD display and the display filter to remove fingerprints and dust particles.
4. Install the new LCD display and reassemble the display assembly in reverse order.
5. Complete the procedures in "Recommended Checkout" on page 7-42.

Replace Main Unit Parts

Use the following procedures to replace the main unit parts:

1. "Remove/Replace Handle Assembly" on page 7-9.
2. "Remove/Replace Display Assembly" on page 7-12.
3. On the following pages find the steps for the part and Dash model you are servicing:
   - "Replace DAS Assembly" on page 7-27.
   - "Replace NBP Pump Assembly" on page 7-32.
   - "Replace Writer Assembly/Writer Flex" on page 7-33.
   - "Replace Speaker Assembly" on page 7-34.
   - "Replace CPU/Battery Housing Assembly" on page 7-35.
   - "Replace Power Supply Assembly" on page 7-37.

Replace DAS Assembly

WARNING
DAS ASSEMBLY — Do NOT open the DAS assembly as this breaks the isolation barrier which may result in patient death or serious injury. The DAS assembly is a field replaceable unit only. There are NO field repairs or adjustments for the DAS assembly.

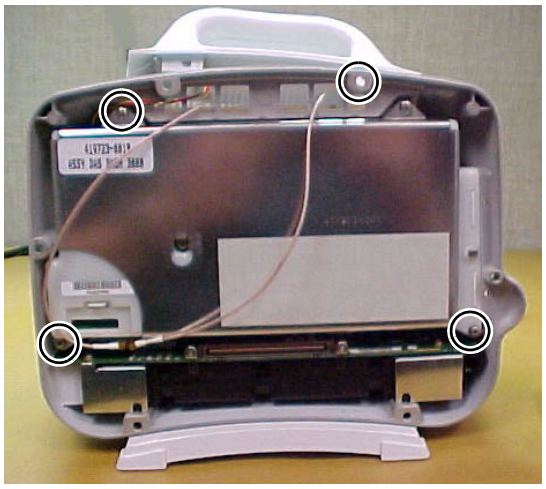
CAUTION
The patient monitor requires software version 5 or later to operate with the Masimo SET SPO2 and 4 BP SuperStat DAS upgrade. If the installation of software version 5 or later is required, GE recommends that you FIRST install the software. Then, install the Masimo SET SPO2 and 4 BP SuperStat hardware upgrade.

1. Remove the handle assembly. Refer to page 7-9.
2. Remove the display assembly from the main unit. Refer to page 7-12.
3. Remove the four screws anchoring the Data Acquisition System (DAS) assembly in place.

CAUTION
CAREFULLY remove the DAS assembly so that you do NOT hit the components on the CPU/battery housing assembly.

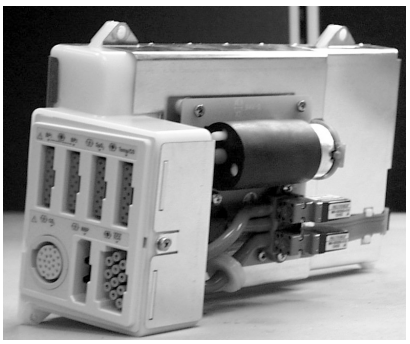
NOTE

On the Dash 5000 patient monitor the top two screws attach to a bracket, not the rear housing as shown.



545A

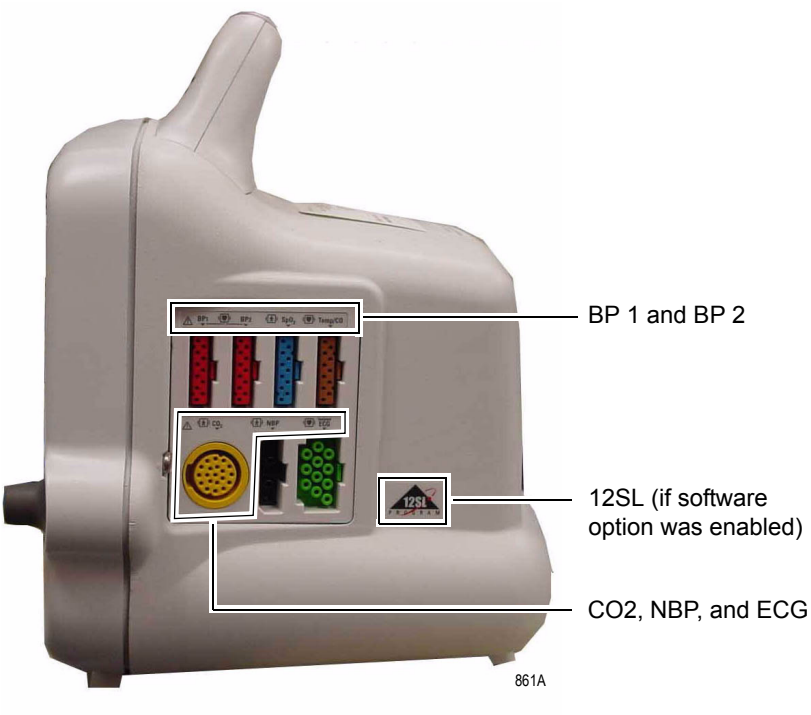
4. Remove the DAS assembly by first pulling the *left* side out 1/4-inch, then sliding the whole assembly out of the patient monitor. If the Wireless LAN option is installed, use a needle nose pliers to remove the antennae by disconnecting both coax connectors from the PC card.



525A

5. Replace the DAS assembly and reassemble the unit reversing the order of removal steps.

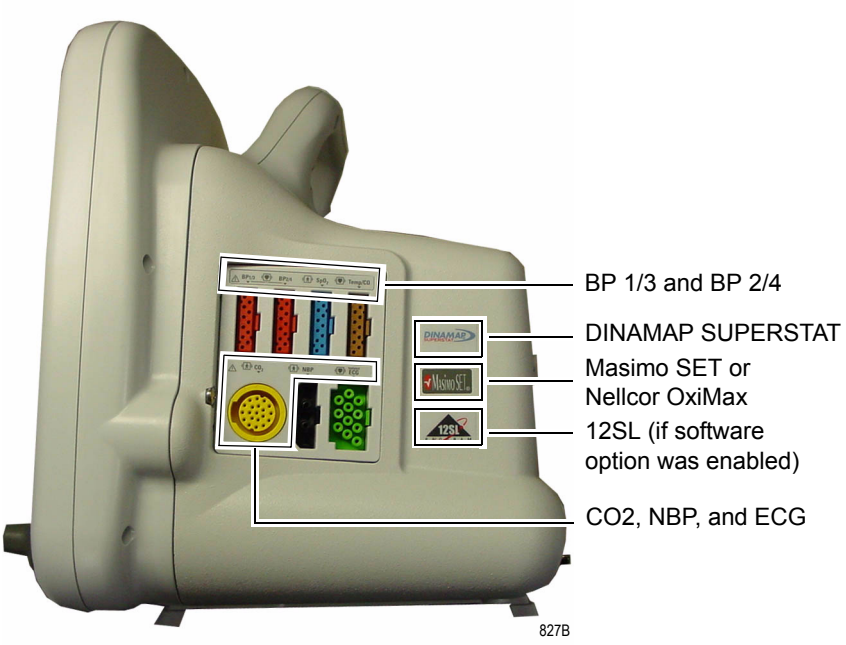
6. If you installed the Generic Ohmeda DAS assembly, place the labels as shown below.



NOTE

The BP 1 and BP 2 label looks similar to the example below.

7. If you installed the Nellcor OxiMax or Masimo SET SPO2 and 4 BP SuperStat upgrade, place the labels as shown below.



NOTE

The BP 1/3 and BP 2/4 label looks similar to the example below.

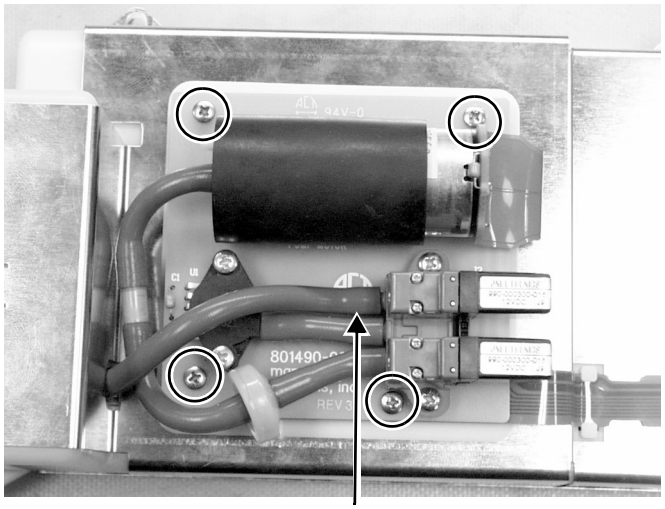
8. Complete the procedures in "Recommended Checkout" on page 7-42.

Replace Wireless Card

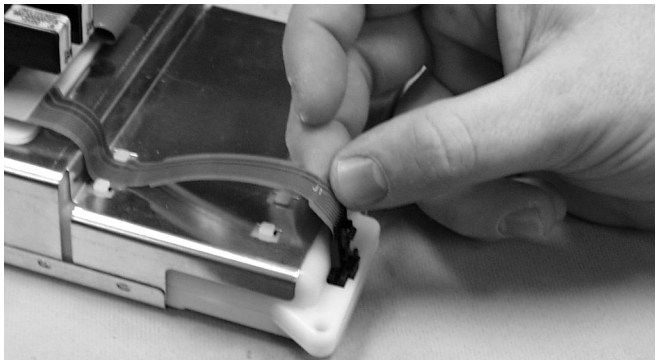
Separate instructions ship with the kit for replacing the wireless card. Please refer to those instructions if replacing a wireless card or upgrading to wireless.

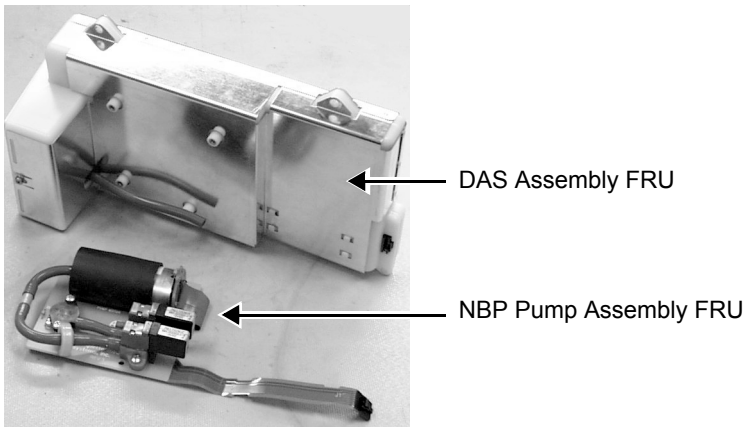
Replace NBP Pump Assembly

1. Remove the DAS assembly according to steps starting on page 7-27.
2. Remove the four screws and remove the NBP assembly from the cover of the DAS assembly.
3. Disconnect the tube from the inner solenoid going into the NBP assembly.



4. Using a small, flat-blade screwdriver, remove the connector from the NBP assembly to the DAS assembly.





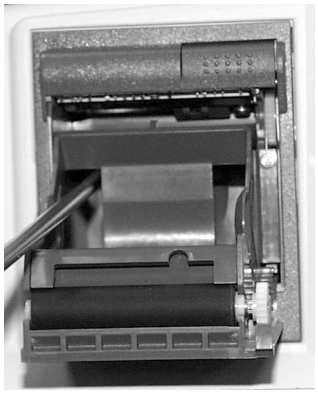
5. Attach the NBP assembly to the DAS assembly. Do not forget:
   - the four mounting screws,
   - the tube connection, and
   - the flex connector.

6. Reassemble the patient monitor in reverse order.

Replace Writer Assembly/Writer Flex

1. Remove the DAS assembly according to steps starting on page 7-27.
2. Remove the writer by unscrewing the two captive screws inside the writer.

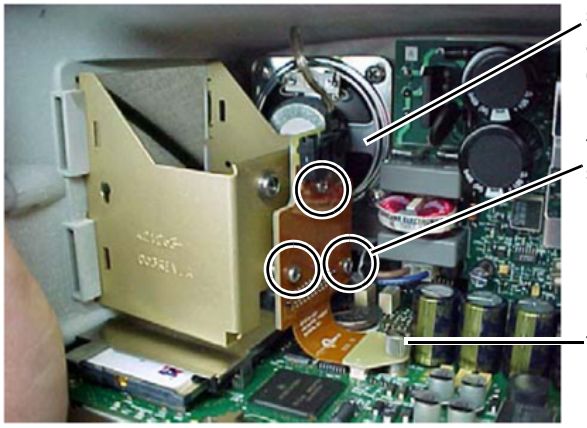
CAUTION
Approach the screw from *below* the top bar on the paper roll holder so that you do not damage the unit.



533A

3. Unscrew the thumb screw anchoring the writer cable to the main assembly and disconnect the flex cable from the CPU/battery housing assembly.

NOTE
When securing the thumb screw for reassembly, first finger-tighten the thumb screw. Then, use a flat-head screw driver to tighten the screw an additional 1/4 turn.

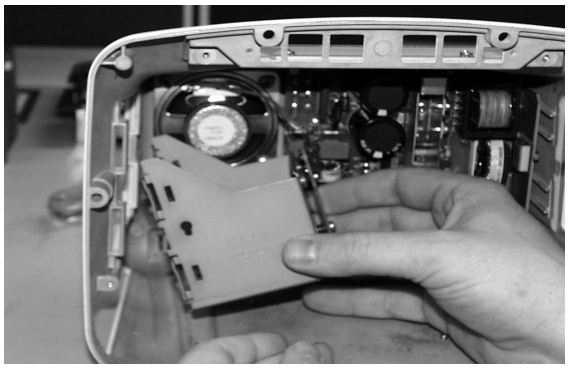


562B

4. Remove the speaker harness and the optional alarm light cable harness from the top of the writer board.
5. Remove three screws holding the writer flex to the writer bracket.
6. Replace writer assembly and/or writer flex and reassemble the patient monitor in reverse order.
7. Complete the procedures in "Recommended Checkout" on page 7-42.

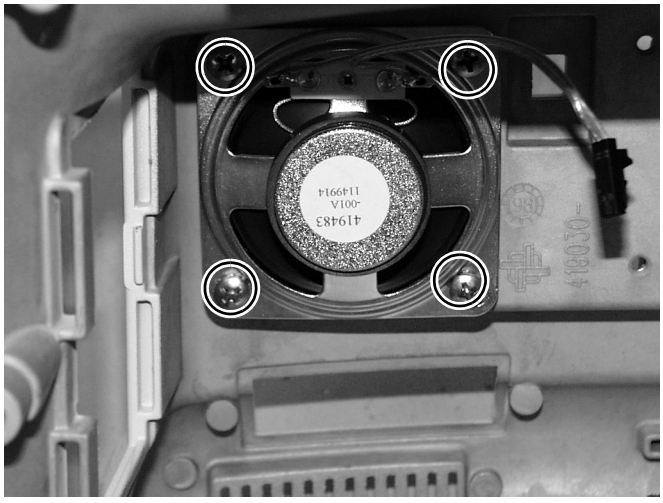
Replace Speaker Assembly

1. Remove the DAS assembly according to steps starting on page 7-27.
2. Remove the writer assembly/writer flex according to steps on page 7-33.
3. Remove the writer bracket from the frame by squeezing the sides together.



532A

4. Remove the four screws anchoring the speaker to the frame. Remove the speaker from the unit.



586A

5. Install the new speaker in the unit with the cable harness positioned at the top (as shown above).
6. Fasten the speaker with the four screws.

7. Reassemble the patient monitor in reverse order.

   NOTE
   When securing the thumb screw on the writer flex, first finger-tighten the thumb screw. Then, use a flat-head screw driver to tighten the screw an additional 1/4 turn.

8. Complete the procedures in "Recommended Checkout" on page 7-42.

Replace CPU/Battery Housing Assembly

1. Remove the DAS assembly according to steps starting on page 7-27.
2. Unscrew the thumb screw anchoring the writer cable to the CPU assembly and disconnect the flex cable from the CPU/battery housing assembly.
3. Remove the three screws anchoring the battery door assembly to the rear housing. Remove the battery door assembly.

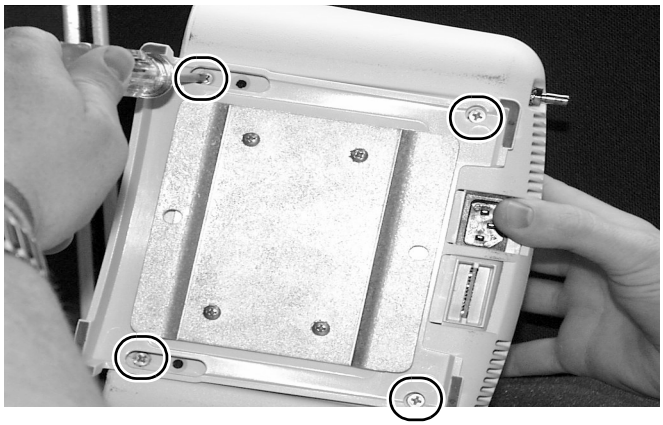
581B

Screws holding battery door.

895A

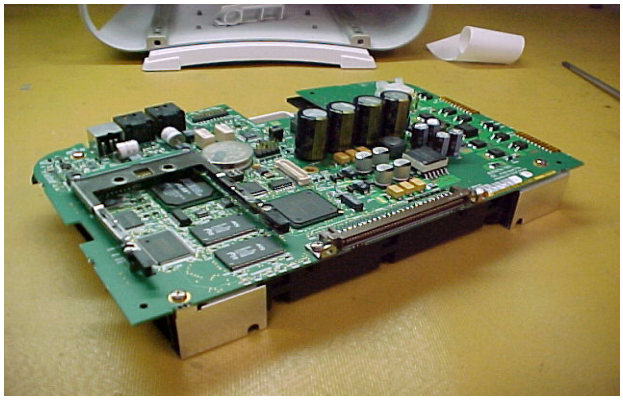
4. If replacing the battery door only, install the new door and reassemble the patient monitor. Otherwise, continue with the next step.

5. Remove the four panhead screws anchoring the CPU/battery housing assembly to the frame. These screws are attached at the bottom of the unit.



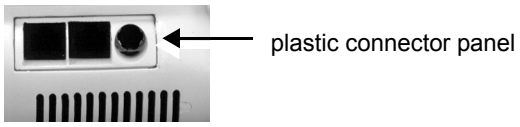
517A

6. CAREFULLY pull the CPU/battery housing assembly from the unit.



547A

7. Remove the plastic connector panel from the three connectors at the back of the CPU/battery housing assembly. Install this panel on the new CPU/battery housing assembly before you slide the new assembly into the rear housing.



572A

8. Install the new assembly in the unit.

NOTE

When securing the thumb screw on the writer flex, first finger-tighten the thumb screw. Then, use a flat-head screw driver to tighten the screw an additional 1/4 turn.

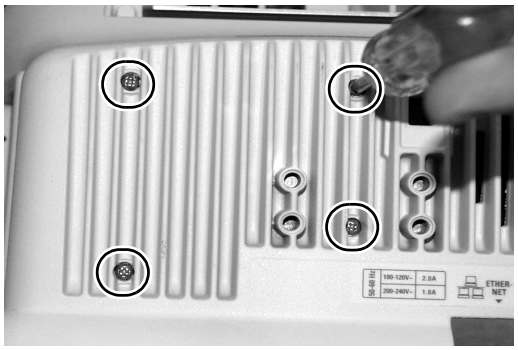
9. Reassemble the patient monitor in reverse order.

10. Be sure to complete the following procedures in "Recommended Checkout" on page 7-42:
    - electrical safety tests
    - checkout procedures
    - calibration

11. Also configure the patient monitor and enable the software options previously installed. Refer to "Configuration" on page 4-1.

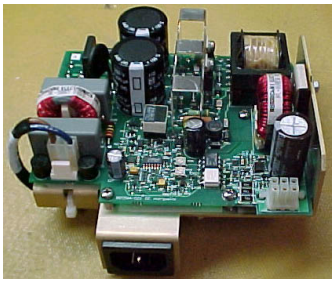
Replace Power Supply Assembly

1. Remove the CPU/battery housing assembly according to steps starting on page 7-35.
2. While holding the power supply assembly with one hand, remove the four screws from the back of the unit.



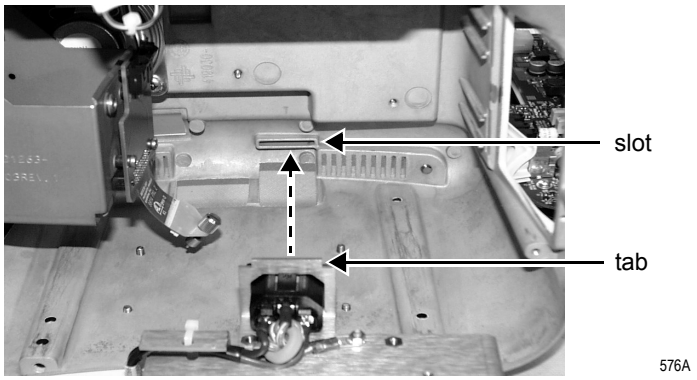
575A

3. Remove the assembly from the unit.



569A

4. Align the tab on the power supply mounting bracket with the slot in the rear housing and install the new assembly in the unit. Fasten the assembly to the rear housing with the new screws.



NOTE

When securing the thumb screw on the writer flex, first finger-tighten the thumb screw. Then, use a flat-head screw driver to tighten the screw an additional 1/4 turn.

5. Reassemble the patient monitor in reverse order.
6. Complete the procedures in "Recommended Checkout" on page 7-42.

Replace Battery Door

1. Remove the three screws anchoring the battery door assembly to the rear housing. Remove the battery door assembly.

581B

Screws holding battery door.

895A

2. Install the new door and reassemble the patient monitor.

Replace Foot

1. Remove four screws holding the foot to the patient monitor.

926A

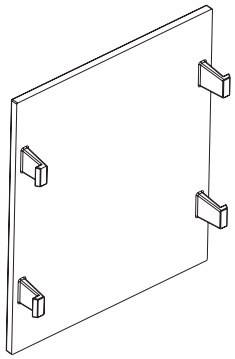
NOTE

Your unit may or may not have a mounting plate. The same four screws anchor the mounting plate and foot.

2. Replace the foot and screw to the patient monitor.

Replace Writer Cover

Dash patient monitors without a writer have a blank door where the writer assembly would be installed. The door snaps into the writer space above the battery door.



927A

Recommended Checkout

After reassembling the patient monitor, ALWAYS complete the electrical safety tests, checkout procedures, calibration tests, and regular maintenance procedures identified and described in this manual.

Recommended Calibration, Electrical Safety Tests, and Checkout Procedures			
Replacement Procedure	**Calibration Tests**	**Checkout Procedures**	**Electrical Safety Tests**
Display assembly **Display assembly components** **Display inverter assembly** **Handle assembly**	None	■ "Patient Monitor Power-up Tests" on page 8-18. ■ "Display Test" on page 8-46. ■ "5 Lead ECG Test" on page 8-19.	■ "Electrical Safety Tests" on page 8-5.
Speaker	None	Complete ALL the Checkout Procedures in "Checkout" on page 8-1.	
Keypad assembly/Trim Knob	None	■ "Patient Monitor Power-up Tests" on page 8-18. ■ "Display Test" on page 8-46.	
DAS assembly	"NBP Calibration" on page 8-38.	■ "ECG Tests" on page 8-19. ■ "Respiration Tests" on page 8-22. ■ "Temperature Tests" on page 8-23. ■ "Cardiac Output Tests" on page 8-24. ■ "Invasive Blood Pressure Tests (option)" on page 8-26. ■ "Pulse Oximetry Tests for GE Ohmeda SPO2 Oximeter" on page 8-30. Use this procedure if you installed a GE Ohmeda DAS assembly. ■ "Pulse Oximetry Tests for Masimo SET SPO2" on page 8-32. Use this procedure if you installed a Masimo DAS assembly. ■ "Pulse Oximetry Tests for Nellcor OxiMax SPO2" on page 8-34. Use this procedure if you installed a Nellcor OxiMax DAS assembly. ■ "Noninvasive Blood Pressure Tests" on page 8-36. ■ Refer to the CO2 chapter in the patient monitor's operator manual to checkout the mainstream End-tidal CO2. ■ To check out the sidestream End-tidal CO_2, refer to the documentation that came with the module.	

Recommended Calibration, Electrical Safety Tests, and Checkout Procedures			
Replacement Procedure	**Calibration Tests**	**Checkout Procedures**	**Electrical Safety Tests**
NBP assembly	"NBP Calibration" on page 8-38.	■ "Noninvasive Blood Pressure Tests" on page 8-36.	■ "Electrical Safety Tests" on page 8-5.
Wireless LAN	None	■ "Patient Monitor Power-up Tests" on page 8-18. ■ "Network Test (option)" on page 8-47. ■ "Wireless LAN Test (option)" on page 8-50.	
Power supply assembly	None	■ "Patient Monitor Power-up Tests" on page 8-18. ■ "End-tidal CO_2 Test (option)" on page 8-44.	
CPU	"End-tidal CO_2 Test (option)" on page 8-44.. "NBP Calibration" on page 8-38.	■ "Patient Monitor Power-up Tests" on page 8-18. ■ "Analog Output and Defibrillator Synchronization Tests" on page 8-41. ■ "Graph/Print Tests" on page 8-45. ■ "Display Test" on page 8-46. ■ "Speaker Test" on page 8-46. ■ "Network Test (option)" on page 8-47. ■ "Wireless LAN Test (option)" on page 8-50. ■ "RAC 2A Module Housing Peripheral Device Test (option)" on page 8-53.	
Writer, writer flex	None	■ "Patient Monitor Power-up Tests" on page 8-18. ■ "Graph/Print Tests" on page 8-45.	

8 Checkout

Overview

Manufacturer Recommendations

These safety tests and checkout procedures provide service personnel with a method to verify operational and functional performance of the patient monitor. Failure to attain any of the listed results indicates a potential malfunction of the patient monitor.

The safety tests and checkout procedures are based on the assumption that the tested patient monitor has known good cables and test equipment. It also requires that the user be familiar with the operation of all test equipment required for the procedures. For more information concerning the operation of these components, refer to the respective operator manual(s).

Frequency

GE recommends that you perform the checkout procedures:

- Upon receipt of the device.
- Every 12 months thereafter.
- Each time the main enclosure is disassembled or a circuit board is removed, tested, or replaced.

Test Equipment

The safety tests and checkout procedures are written for the GE recommended test equipment listed for each test. If you use test equipment other than those GE recommends, you may need to slightly modify some test steps.

Maintenance and Checkout Checklist

Use the following checklist to ensure maintenance completion.

☐ "Visual Inspection" on page 5-3

1. ____ General condition
2. ____ Connectors
3. ____ Cable insulation
4. ____ Display
5. ____ Safety labels and inscription

☐ "Cleaning" on page 5-4

1. ____ Display
2. ____ Exterior surfaces
3. ____ Print head

☐ "Battery Maintenance" on page 5-6

☐ "Electrical Safety Tests" on page 8-5

1. ____ Power outlet
2. ____ Power cord and plug
3. ____ Ground (earth) integrity
4. ____ Ground (earth) wire leakage
5. ____ Enclosure leakage test
6. ____ ECG Patient (source) leakage current test
7. ____ SpO_2 Patient (source) leakage current test
8. ____ ECG Patient (sink) leakage current (mains voltage on the applied part)
9. ____ BISx (option) Current Leakage Test
10. ____ SpO_2 Patient (sink) leakage current (mains voltage on the applied part)

☐ "Checkout Procedures" on page 8-17

1. ____ "Patient Monitor Power-up Tests" on page 8-18
2. ____ "ECG Tests" on page 8-19
3. ____ "Respiration Tests" on page 8-22
4. ____ "Temperature Tests" on page 8-23
5. ____ "Cardiac Output Tests" on page 8-24
6. ____ "Invasive Blood Pressure Tests (option)" on page 8-26
7. ____ "Pulse Oximetry Tests for GE Ohmeda SPO2 Oximeter" on page 8-30
8. ____ "Pulse Oximetry Tests for Masimo SET SPO2" on page 8-32
9. ____ "Pulse Oximetry Tests for Nellcor OxiMax SPO2" on page 8-34
10. ____ "Noninvasive Blood Pressure Tests" on page 8-36
11. ____ "NBP Calibration" on page 8-38
12. ____ "Analog Output and Defibrillator Synchronization Tests" on page 8-41
13. ____ "End-tidal CO_2 Test (option)" on page 8-44
14. ____ "Battery Tests" on page 8-45
15. ____ "Graph/Print Tests" on page 8-45
16. ____ "Display Test" on page 8-46
17. ____ "Speaker Test" on page 8-46
18. ____ "Network Test (option)" on page 8-47
19. ____ "Remote Control Test (option)" on page 8-47
20. ____ "BISx Test (option)" on page 8-48
21. ____ "Wireless LAN Test (option)" on page 8-50
22. ____ "Dash Port Docking Station Test (option)" on page 8-53
23. ____ "RAC 2A Module Housing Peripheral Device Test (option)" on page 8-53
24. ____ "Data Acquisition Tests" on page 8-54

Electrical Safety Tests

General

Electrical safety tests provide a method of determining if potential electrical health hazards to the patient or operator of the device exist.

Recommendations

GE recommends that you perform all safety tests presented in this chapter.

- upon receipt of the device (patient monitor and its associated equipment),
- every twelve months thereafter,
- each time the main enclosure is disassembled or a circuit board is removed, tested, repaired, or replaced, and
- record the date and results on the "Maintenance/Repair Log" included at the end of this chapter.

These instructions are intended for every component in the system. If the Tram-rac housing does not have its own power supply, it should remain connected to the patient monitor throughout the safety tests.

WARNING
Failure to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards. Unless you have an Equipment Maintenance Contract, GE does not in any manner assume the responsibility for performing the recommended maintenance procedures. The sole responsibility rests with the individual or institution using the equipment. GE service personnel may, at their discretion, follow the procedures provided in this manual as a guide during visits to the equipment site.

Test Conditions

Electrical safety tests may be performed under normal ambient conditions of temperature, humidity, and pressure.

Test Equipment

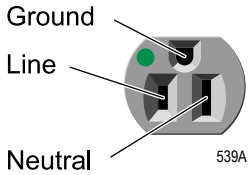
The recommended test equipment required to perform electrical safety tests is listed below.

Item	Specification
Leakage Current Tester	Equivalent to the circuits shown
Digital Multimeter (DMM)	AC volts, ohms
Ground Bond Tester	0 – 1 ohm
ECG Test Body	All leads together
Masimo SET SPO2 Test Body	2006036-001
GE and Nellcor SPO2 Test Body	2006646-001
Sensor Plus Simulator (for BISx option)	2007695-001 or equivalent

Power Outlet Test

Before starting the tests, the power outlet from which the monitoring device will get electrical power must be checked. This test checks the condition of the power outlet to ensure correct results from leakage tests.

A standard power outlet consists of three connections: line, neutral and ground. The figure below indicates the location of each on a 120 VAC power outlet commonly used in the United States. The location and shape of pins may be different on power outlets used in countries other than the United States.



For international power outlets, refer to the internal standards agencies of that particular country.

If other than normal polarity and ground is indicated, corrective action must be taken before proceeding. The results of the following tests will be meaningless unless a properly wired power outlet is used.

Use this procedure to verify that the AC power outlet that the patient monitor is plugged into is correctly wired. This is accomplished by performing a:

- voltage measurement between all three connections of the power outlet, and
- ground-to-neutral loop resistance measurement.

1. Use a digital multimeter (DMM) to measure the voltage between the three connections.
   a. Select the AC voltage scale on the DMM.
   b. Measure the voltage from line to neutral, line to ground, and neutral to ground and make sure these are correct. With a correctly wired power outlet used in the United States, the following readings should be obtained:

      Line to neutral: 120 VAC
      Line to ground: 120 VAC
      Neutral to ground: < 3 VAC

      Readings other than these indicate improper wiring. Have the power outlet checked by an electrician.
2. Use a DMM to measure the ground-to-neutral loop resistance.

   CAUTION
   DO NOT check the ground-neutral loop resistance unless the power outlet is correctly wired.

   a. Select the milliohms (mΩ) scale on the DMM.
   b. Measure resistance across the power cord ground and neutral.
   c. Measure from the ground lug on the rear power connector to any exposed metal of the patient monitor. The resistance between the ground and neutral connections, after the ohmmeter is nulled, must be less than 100 mΩ. If not, have the power outlet checked by an electrician.

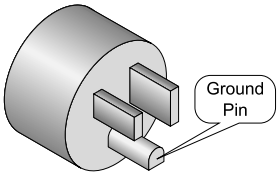
Power Cord and Plug

Verify the power cord being used with the patient monitor is good. The following are a couple of things to check for in this regard:

- Failure of the power cord strain relief is very common. Often times users of the equipment pull on the power cord itself, rather than the power cord plug, to unplug the patient monitor from a wall receptacle. If in doubt, test for continuity through each conductor of the power cord connector and plug.
- Verify line, neutral, and ground conductors are properly connected to the power cord plug and are not short-circuited. Rewire and tighten these, or replace the power cord, as necessary.

Ground (Earth) Integrity

Listed below are two methods for checking the ground (earth) integrity, “Ground Continuity Test” and “Impedance of Protective Earth Connection.” These tests determine whether the device's exposed metal and power inlet's earth (ground) connection has a power ground fault condition.



Perform the test method below that is required by your Country/Local governing safety organization.

Ground Continuity Test

Completion of this test is checked by the following steps:

1. Disconnect the device under test from the power outlet.
2. Connect the negative (-) lead of the DMM to the protective earth terminal (ground pin in power inlet connector) or the protective earth pin in the Mains plug (ground pin in power cord). Refer to the US 120Vac power cord figure above.
3. Set the DMM to the milliohm (mΩ) range.
4. Connect the positive (+) lead of the DMM to all exposed metal surfaces on the device under test. If the metal surfaces are anodized or painted, scrape off a small area in a inconspicuous place for the probe to make contact with the metal.
5. Resistance must read:
   - 0.1 ohm or less without power cord
   - 0.2 ohms or less with power cord

Impedance of Protective Earth Connection

This test unlike a ground continuity test will also stress the ground system by using special ground bond testers.

This test normally is only required as a manufacturing production test to receive safety agency compliance (i.e. IEC 60601-1).

Some country agency's do require this test after field equipment repairs (i.e. Germany's DIN VDE 0751 standards).

Consult your country/local safety agency if in question.

Compliance is checked by the following steps:

1. A current not less than 10A and not exceeding 25A from a current source with a frequency of 50 or 60 Hz with a no-load voltage not exceeding 6 V is passed for at least 5 s through the protective earth terminal or the protective earth pin in the mains plug and each accessible metal part which could become live in case of failure in basic insulation.
2. The voltage drop between the parts described is measured and the impedance determined from the current and voltage drop. It shall not exceed the values indicated.

For equipment without a power supply cord the impedance between the protective earth terminal and any accessible metal part which is protectively earthed shall not exceed 0.1 ohms

For equipment with a power supply cord the impedance between the protective earth pin in the mains plug and any accessible metal part which is protectively earthed shall not exceed 0.2 ohms.

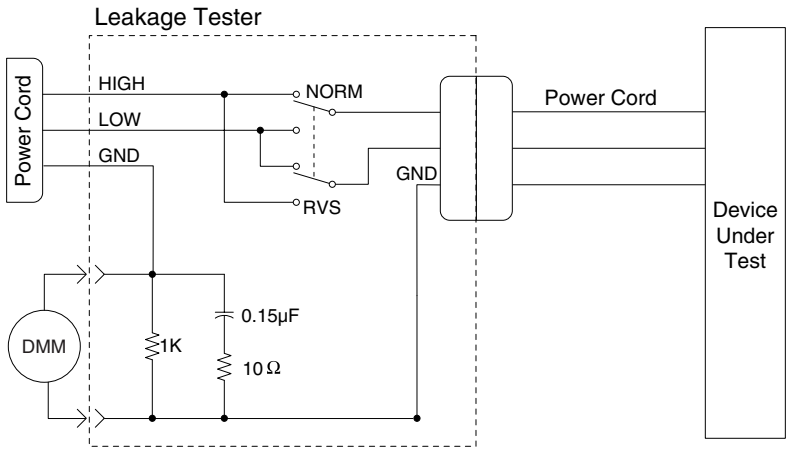
When taking this measurement, move the unit's power cord around. There should be no fluctuations in resistance.

Ground (Earth) Wire Leakage Current Tests

Perform this test to measure current leakage through the ground (earth) wire of the equipment during normal operation.

The device under test is to be tested at its normal operating voltage.

1. Configure the leakage tester like the circuit shown below with normal polarity and NEUTRAL closed.



DMM set to measure AC voltage

2. Connect the power cord of the device under test to the power receptacle on the leakage tester.
3. Apply power to the device under test.
4. Read the current leakage indicated on DMM.
5. Set the polarity switch on the leakage tester to RVS (reverse).
6. Read the current leakage indicated on DMM.

NOTE

If either reading is greater than the appropriate specification below, the device under test fails. Contact GE Technical Support.

- 300 µA (0.3 volts on the DMM), and the device under test is powered from 100-120 V/50-60 Hz
- 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200-240 V/50-60 Hz, single phase circuit
- 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200-240 V/50-60 Hz, single-phase circuit

NOTE

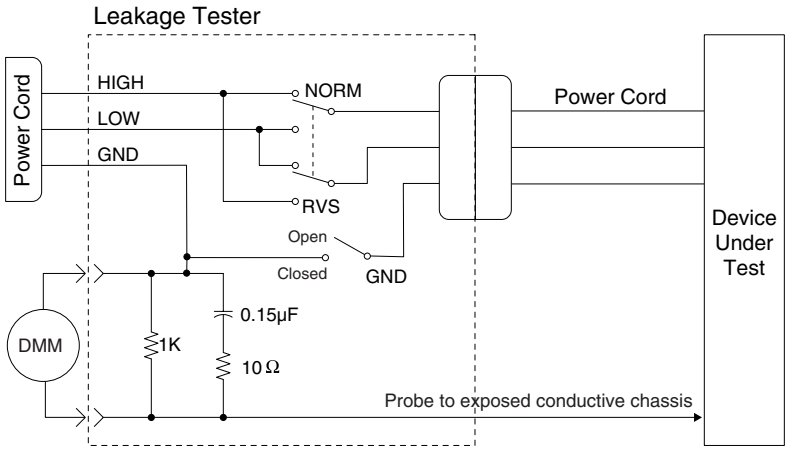
Center-tapped and non-center-tapped supply circuits produce different leakage currents and the UL and IEC limits are different.

7. Repeat steps 1 through 7 with NEUTRAL open.
8. Set the power switch of the device under test to OFF.

Enclosure Leakage Current Test

Perform this test to measure current leakage through exposed conductive surfaces on the device under test during normal operation.

1. Configure the leakage tester like the circuit shown below with GND switch OPEN and polarity switch NORM.



DMM set to measure AC voltage

2. Connect probe to an unpainted, non-anodized chassis ground on the unit under test (Equipotential lug).
3. Set the power switch of the device to ON.
4. Read the current leakage indicated on DMM.

NOTE

Center-tapped and non-center-tapped supply circuits produce different leakage currents and the UL and IEC limits are different.

5. Set the polarity switch to RVS.
6. Read the current leakage indicated on DMM.

NOTE

If either reading is greater than the appropriate specification below, the device under test fails. Contact GE Technical Support.

- 300 µA (0.3 volts on the DMM), and the device under test is powered from 100-120 V/50-60 Hz
- 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200-240 V/50-60 Hz, single phase circuit
- 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200-240 V/50-60 Hz, single-phase circuit

7. Set the GND switch on the leakage tester to CLOSED.
8. Read the current leakage indicated on DMM.
9. Set the polarity switch to RVS.
10. Read the current leakage indicated on DMM.

NOTE

If the reading is greater than the specification below, and the device under test is powered from 100-240 V/50-60 Hz, the device under test fails. Contact GE Technical Support.

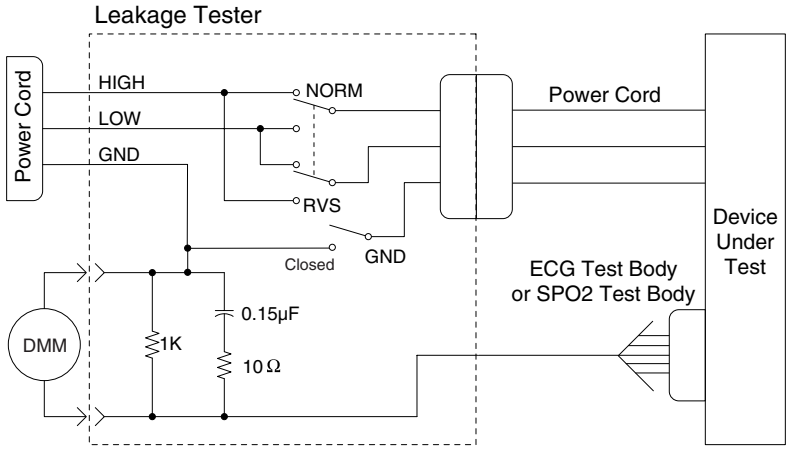
- 100 microamperes (0.1 volts on the DMM), and the device under test is powered from 100-240 V/50-60 Hz

11. Set the power switch of the device under test to OFF.

Patient (Source) Leakage Current Test

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from the ECG/RESP connector or the SPO2 connector of the device to ground.

1. Configure the leakage tester like the circuit shown below with GND switch OPEN and polarity switch NORM.



DMM set to measure AC voltage

2. Connect an ECG test body to the ECG/RESP connector of the device under test.
3. Set the power switch of the device to ON.
4. Read the leakage current indicated on the DMM.
5. Change the leakage tester polarity switch to the RVS position.
6. Read the leakage current indicated on the DMM.

NOTE

If either reading is greater than 50 µA (0.05 volts on the DMM), the device fails this test. Contact GE Technical Support.

7. Change the GND switch to the Closed position.
8. Read the leakage current indicated on the DMM.
9. Change the leakage current switch to the RVS position.
10. Read the leakage current indicated on the DMM.

NOTE

If either reading is greater than 10 µA (0.01 volts on the DMM), the device fails this test. Contact GE Technical Support.

11. Set the power switch of the device to OFF.

NOTE

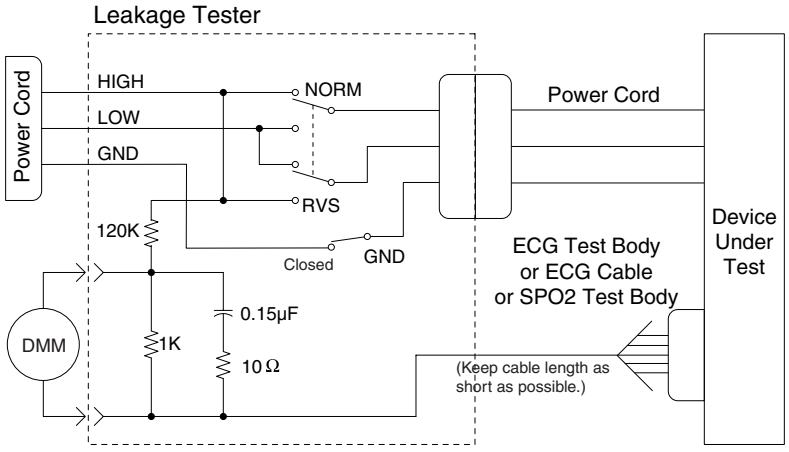
The AAMI and IEC single fault condition (ground open) is 50 µA, whereas the normal condition (ground closed) is less.

12. Repeat the steps in this procedure using the appropriate GE or Masimo SET SPO2 Test Body. Connect the SPO2 Test Body to the blue SPO2 connector of the device under test.

Patient (Sink) Leakage Current Test (Mains Voltage on the Applied Part)

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from a mains voltage source into the ECG/RESP connector.

1. Configure the leakage tester like the circuit shown below with GND switch CLOSED and polarity switch NORM.



DMM set to measure AC voltage

WARNING

Shock hazard. The following step causes high voltage at the test body. Do not touch the test body.

2. Set power switch on the device to ON.
3. Read leakage current indicated on DMM.
4. Change the leakage tester polarity switch to the RVS position.

5. Read the leakage current indicated on the DMM.

   NOTE

   If either reading is greater than the appropriate specification below, the device under test fails. Contact GE Technical Support.

   - 10 µA (0.01 volts on the DMM) at 120 VAC using the test body.
   - 20 µA (0.02 volts on the DMM) at 240 VAC using the test body.
   - 50 µA (0.05 volts on the DMM) at 120-240 VAC using the ECG cable.

     NOTE

     The 10 and 20 µA limits are based on internal design standards. The 50 µA limit is common to all standards. AAMI ES-1 standard requires using the patient cable.

6. Set the power switch on the device to OFF.
7. Repeat the steps in this procedure using the appropriate GE or Masimo SET SPO2 Test Body. Connect the SPO2 Test Body to the blue SPO2 connector of the device under test.

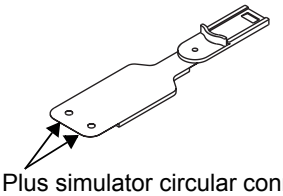
BISx (option) Current Leakage Tests

These procedures test the integrity of the BISx isolation only, not the entire system.

BISx Patient (Source) Leakage Current Test

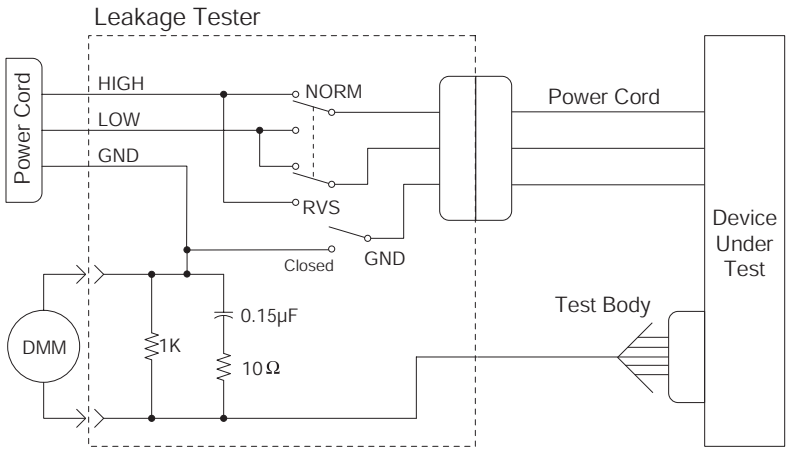
This test checks leakage current from the patient cable connector of the BISx to ground.

1. Connect the Sensor Plus simulator to the BISx and connect the two circular Sensor Plus simulator connections (test body) to the leakage tester.



Sensor Plus simulator circular connections

2. Configure the leakage tester like the circuit shown below with GND switch OPEN, polarity switch NORM and power switch OFF.



DMM set to measure AC voltage

3. Connect the BISx power supply cord to the power outlet on the leakage tester.
4. Set the leakage tester power switch to ON.
5. Turn the BISx ON by connecting the AC power adaptor.
6. Read the leakage current indicated on the DMM.
7. Change the leakage tester polarity switch to the RVS position.
8. Read the leakage current indicated on the DMM

NOTE

If either reading is greater the 500 µA, the BISx fails this test. Contact GE Technical Support.

9. Change the GND switch to the CLOSED position.
10. Read the leakage current indicated on the DMM.
11. Change the leakage tester polarity switch to the RVS position.
12. Read the leakage current indicated on the DMM
13. Set the power switch of the leakage tester to OFF.

NOTE

If either reading is greater the 100 µA, the BISx fails this test. Contact GE Tech Support.

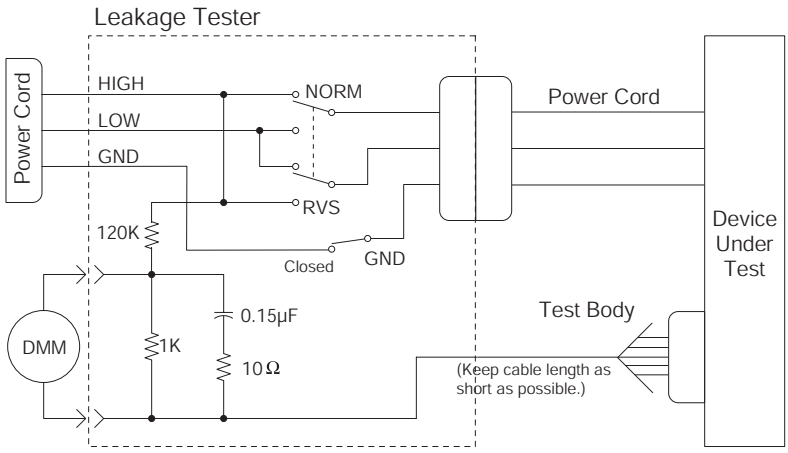
The AAMI and the IEC single fault condition (ground open) is 500 µA, whereas the normal condition (ground closed) is 100 µA.

14. Leave the test configuration set up for the sink leakage test.

BISx Patient (Sink) Leakage Current Test

This test checks the patient cable leakage current from a 115 or 220VAC source into the BISx.

1. With the Sensor Plus simulator connected to the BISx and the two circular Sensor Plus simulator connections (test body) connected to the leakage tester, configure the leakage tester like the circuit shown below with GND switch CLOSED, polarity switch NORM and power switch OFF.



DMM set to measure AC voltage

WARNING
Shock hazard. The following step causes high voltage at the test body. Do NOT touch the test body.

2. Set the power switch of the leakage tester to ON.
3. Read leakage current indicated on the DMM.
4. Change the leakage tester polarity switch to the RVS position.
5. Read the leakage current indicated on the DMM.
6. Set the power switch on the leakage tester to OFF.

NOTE
If either reading is greater the 5000 µA, the BISx fails this test. Contact GE Technical Support.

Test Completion

1. Disconnect the leakage tester from the power outlet.
2. Disconnect all test equipment from the device.
3. Disconnect the device power cord from the leakage tester.

Checkout Procedures

Frequency

GE recommends that you perform the checkout procedures:

- Upon receipt of the device.
- Every 12 months thereafter.
- Each time the main enclosure is disassembled or a circuit board is removed, tested, or replaced.

Identify Enabled Patient Parameters and Software Options

The check out procedures support all enabled patient parameter and software options. To view the options enabled on the patient monitor, go to the Main Menu and select *MORE MENUS > MONITOR SETUP > SOFTWARE CONFIGURATION*.

The following is a list of all available patient parameter and software options.

- 0BP (invasive)
- 1BP or 2BP (invasive)
- 3BP or 4BP (invasive)
- 12SL
- ACI-TIPI
- HI-RES TRENDS
- $ETCO_2$ (CO_2) (End-tidal CO_2)
- NETWORK
- AVOA Plus
- CARDIO-PULMONARY
- CARDIAC

Patient Monitor Power-up Tests

NOTE

When the patient monitor is connected to a docking station, use the docking station's power cable instead of the patient monitor's power cable.

1. Remove the batteries and unplug the patient monitor (or the docking station) from AC power to turn the patient monitor off.
2. Restore the batteries to the patient monitor and plug the patient monitor (or the docking station) into AC power to turn the patient monitor on.
3. Verify all of the front panel indicators illuminate on power up.
4. Verify the AC indicator on the patient monitor stays illuminated.

   NOTE

   If the AC LED stays on, but the screen is blank, the patient monitor is likely in "standby mode" (battery charging). Press the **POWER** button to enter the normal mode.

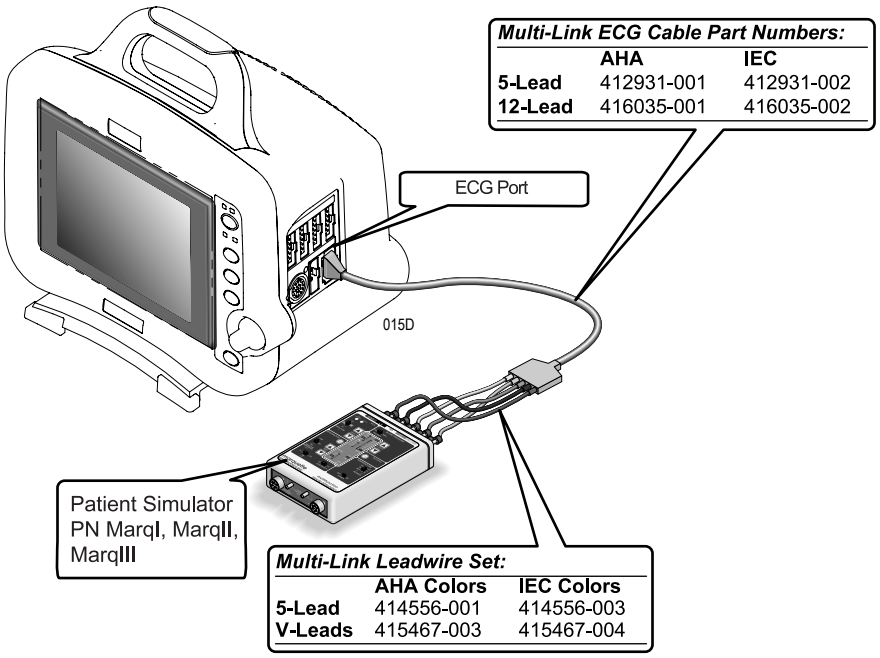
   - If the AC indicator is on, continue with the tests.
   - If either of the **CHARGING STATUS** indicators is yellow, wait for the battery(ies) to fully charge and the indicators to illuminate green. The batteries may take up to four hours to charge.
   - If the battery "fuel gauge" displays the word "ERROR," the battery may be asleep. Refer to "Error Messages" on page 6-5.
5. Verify the optional alarm indicator lights both red and amber on power up.
6. Verify an audio "Beep" sounds at the end of Boot up.
7. Test all of the front panel keys and the **Trim Knob** control. Verify that an audio "Beep" sounds after each key press.
8. Check battery power for both batteries.
   - Unplug the patient monitor (or the docking station) from AC power and open the battery door. Verify one LED in the battery compartment is on (batteries must have more than 10% charge).
   - Pull that battery out and verify the other LED lights, thus indicating the unit is powered by the other battery.
   - Reinstall battery and plug in patient monitor (or the docking station).

ECG Tests

Equipment

Use the following equipment for these tests:

- MarqI, MarqII, or MarqIII patient simulator or an equivalent 12SL ECG patient simulator.
  - Marq-I ECG Simulator (no longer available for ordering)
  - MarqII-KIT (includes CO injectate box. No longer available for ordering)
  - MarqIII-KIT (includes CO injectate box)
- ECG Patient Cable
- ECG Leadwire Set

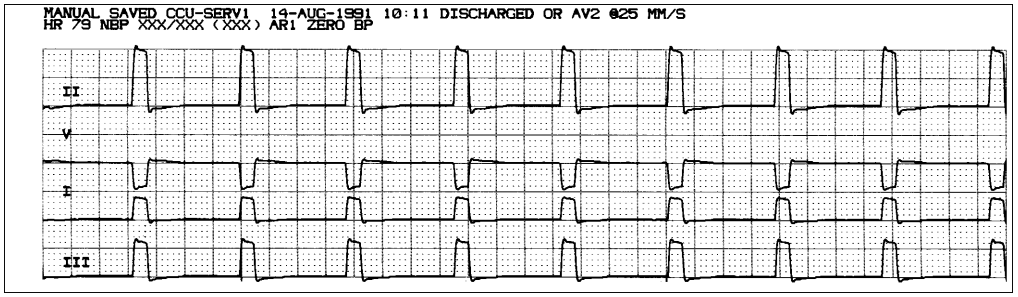


5 Lead ECG Test

Perform this test if the patient monitor acquires 5 lead ECG data.

1. Set up the patient simulator as follows.
   - Heart rate – 80 bpm.
   - Heart rate amplitude – 1.0 mV.
   - 5-lead ECG patient cable properly attached.
   - 2x gain for a MarqI, MarqII, or MarqIII simulator.
2. Attach the ECG patient cable and ECG leadwire set to the **ECG/ RESP** connector on the patient monitor and the leadwire connectors on the top of the patient simulator.
3. Admit the patient simulator to the patient monitor.

4. Observe the following:
   - ECG lead II is displayed and is noise-free,
   - Heart rate of 80 ±1 bpm is displayed,
   - With QRS tones enabled, an audible tone sounds with each R-Wave (QRS complex).
5. Verify all six ECG leads are available to view and are noise-free.
6. Select *DETECT PACE* and set to *PACE 2*.
7. Select a pacemaker pulse on the simulator.
8. Observe the following while you view ECG leads I, II, III, aVL, aVF, and AVR:
   - a "P" appears above the PVC count indicating pacemaker pulse detection is enabled, and
   - the heart rate still reads 80 ±1 bpm.
9. Disable pacemaker pulse detection on the patient monitor and return the simulator to these conditions:
   - Heart rate – 80 bpm,
   - Heart rate amplitude – 1.0 mV,
   - 5-lead ECG patient cable properly attached.
10. Select ECG lead II to view in the top trace position on the patient monitor display.
11. Disconnect the RA leadwire from the patient simulator.
12. Observe that:
    - an RA FAIL message appears on the display, and
    - lead III automatically displays in place of lead II in the top trace position.
13. Reconnect the RA leadwire to the patient simulator.
14. Inject a 1-millivolt calibration signal using the patient simulator and start a manual graph.
15. Observe that the calibration pulse properly displays and graphs.



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16. This completes the 5 Lead ECG test. Leave the ECG patient cable connected to **ECG/RESP** and continue to the next steps of these checkout procedures.

12SL and ACI-TIPI ECG Test (option)

Perform this test if your patient monitor uses the 12SL ACI-TIPI ECG option.

1. Set up the patient simulator as follows:.
   - Heart rate – 80 bpm.
   - Heart rate amplitude – 1.0 mV.
   - 12SL ECG patient cable (5-leads with V leads) properly attached.
   - 2x gain for a MarqI, MarqII, or MarqIII simulator.
2. Select *ECG* from the patient monitor menu. Then, select *12 LEAD ECG ANALYSIS*.
3. Verify that the patient monitor is displaying 10 noise-free leads.
4. Select *12LD ECG NOW*. Wait for the patient monitor to acquire and analyze the data.
5. Select Transmit-Print.
6. Verify the 12SL ECG prints at the print location assigned in the patient monitor's Print Setup >12SL Print Location.
   - If there is no print location is assigned, an error message appears on the bottom of the patient monitor's display.
7. Verify the ECG is transmitted to the MUSE Cardiovascular Information System. Verify the ECG prints out correctly as defined by the MUSE system.
   - If no MUSE system is connected, an error message appears on the bottom of the patient monitor's display.
8. Delete this test 12SL ECG from the MUSE system's edit list.

Respiration Tests

1. With the ECG patient cable connected to the **ECG/RESP** connector of the patient monitor, set up the patient simulator as follows:
   - Respiration (RESP) baseline impedance – 750Ω (or 1000Ω if using Marq II or MarqIII),
   - RESP ΔR – 0.5Ω,
   - RESP lead select – I & II (or LL if using Marq II or MarqIII),
   - RESP rate (respirations per minute) – 30.
2. Set up the patient monitor as follows:
   - RESP waveform – on,
   - RESP waveform lead select – lead II (RESP waveform derived from ECG lead II).
3. Observe the following:
   - RESP parameter window appears on the patient monitor with a reading of 30 ±2 (respirations per minute),
   - RESP waveform appears distortion-free on the patient monitor.
4. Change the RESP waveform lead select of the patient monitor to lead I (RESP waveform derived from ECG lead I), LA at the simulator.
5. Observe the following:
   - RESP parameter window appears on the patient monitor with a reading of 30 ±2 (respirations per minute),
   - RESP waveform appears distortion-free on the patient monitor.
6. Disconnect the ECG patient cable from the **ECG/RESP** connector of the patient monitor. Proceed to the next steps in these checkout procedures.

Temperature Tests

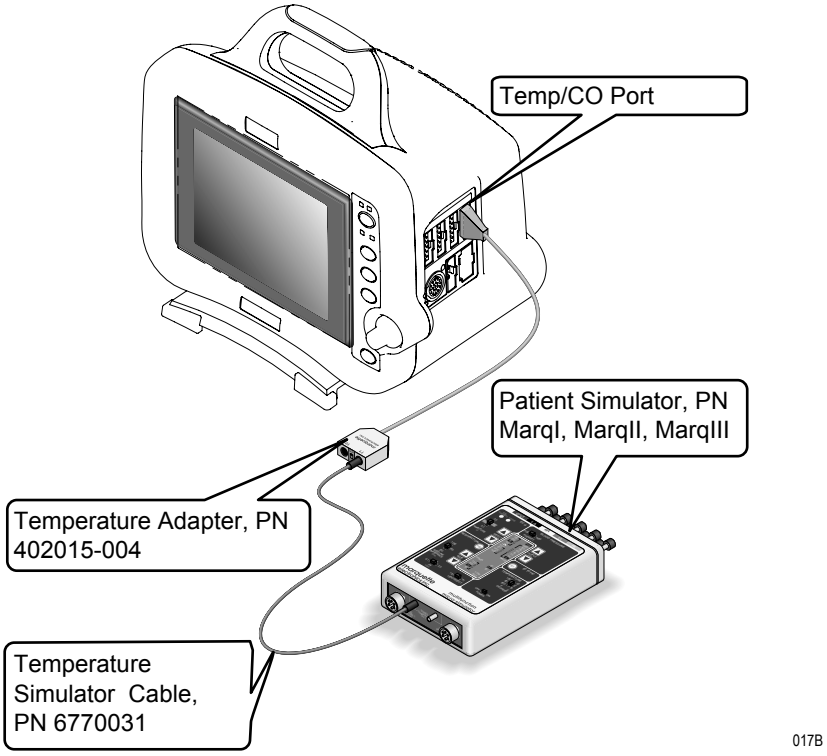
Equipment

Use the following equipment for these tests:

- 700/400 Series Dual Temperature Adapter (402015-004)
- Temperature Simulator Cable for use with Marq-I only (6770031)

Procedures

1. Set up the patient simulator for a temperature output of 37°C.
2. Attach the temperature adaptor cable to the **TEMP/CO** connector of the patient monitor.
3. Set the switch on the temperature adaptor to the 400 position.
4. Attach the temperature simulator cable from the SERIES 400 TEMPERATURE OUTPUT connector of the patient simulator to the **T1** connector of the temperature adaptor.



5. Verify a TEMP parameter window appears on the patient monitor display with a T1 reading of 37.0° ±0.4° C.
6. Move the temperature simulator cable from the **T1** connector of the temperature adaptor to the **T2** connector of the temperature adaptor.
7. Verify a T2 reading of 37.0° ±0.4° C in the TEMP parameter window on the patient monitor display.

8. Repeat the above procedure using 700 settings on simulator and cable.
9. Remove the temperature adaptor and temperature simulator cable from the patient monitor and patient simulator.

Cardiac Output Tests

Equipment

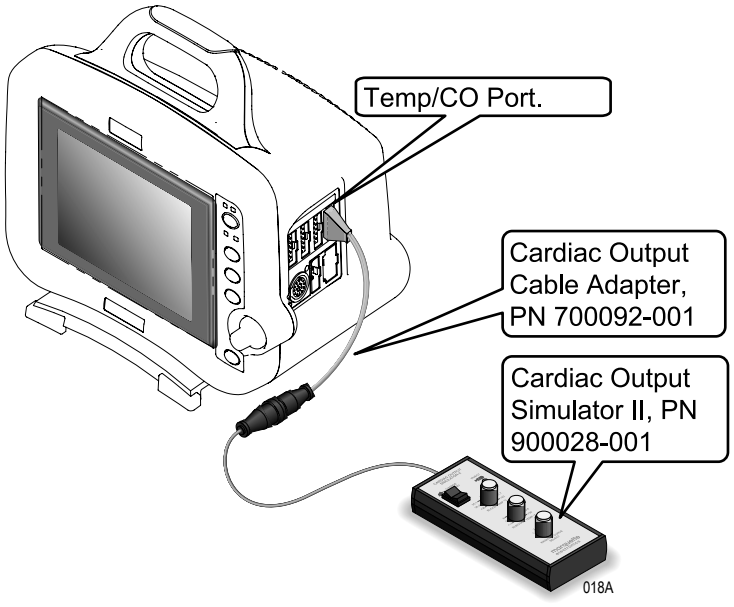
Use the following equipment for these tests:

- Cardiac Output Simulator II (900028-001) (no longer available for ordering)
- Cardiac Output Cable Adapter (700092-001)

Cardiac output testing is different depending on the simulator you use. The Cardiac Output Simulator II is no longer available, but if you already have that simulator, use the first section to run this test. Otherwise, go to "Test with Marq II or MarqIII Simulator."

Test with Cardiac Output Simulator II

1. Connect the cardiac output (CO) cable adaptor to the **TEMP/CO** connector of the patient monitor.
2. Connect a simulator cable between the CO cable adaptor and the CO simulator.



3. Set the CO simulator to output blood temperature (BT) readings, as found in the following table:

Simulator BT Setting	Patient Monitor BT Reading Range
30.3°C	30.1 – 30.5
35.1°C	34.9 – 35.3
36.0°C	35.8 – 36.2
37.0°C	36.8 – 37.2
41.7°C	41.5 – 41.9

4. Verify a CO parameter window appears on the patient monitor display with correct BT readings as shown in the table above.
5. Set the CO simulator to output injectate temperature (IT) readings, as found in the following table:

Simulator IT Setting	Patient Monitor IT Reading Range
0.0°C	–0.3 – +0.3
8.0°C	7.7 – 8.3
15.0°C	14.7 – 15.3
24.0°C	23.7 – 24.3
29.6°C	29.3 – 29.9

6. Verify correct IT readings appear on the patient monitor display, as shown in the table above.
7. Disconnect the CO cable adaptor from the **TEMP/CO** connector of the patient monitor. This completes the CO tests.

Test with Marq II or Marq III Simulator

1. Connect the cardiac output cable adapter to the **TEMP/CO** connector of the Tram module.
2. Connect the cardiac output adapter to the cardiac output cable adapter and to the Marq II or to the MarqIII simulator.
3. At the patient monitor, select *MORE MENUS >CO*.
4. Set up the patient monitor:
   a. Set *AUTO MODE:* to *ON*
   b. Set *INJECT TEMP:* to *BATH*
   c. Set *SIZE:* to *7*
   d. Set *INJECT VOL:* to *10CC*
   e. Set *COMPUTATIONAL CONSTANT:* to *0.540*
5. Set the adapter to **0°**.
6. Turn the simulator ON. Select cardiac output menu corresponding to the injectate temperature. (i.e. menu #92 for 0°, or #95 for 24°)
7. When the patient monitor screen displays the message, *INJECT WHEN READY*, press **Enter** on the simulator.
8. When computing is complete, the CO reading should be approximately 37°C at 5 liters of blood per minute ± 5%.
9. Repeat this test with the adapter set to **24°** and the *COMPUTATIONAL CONSTANT:* set to 0.595.
10. The output should be the same.

Invasive Blood Pressure Tests (option)

Equipment

Use the following equipment for these tests:

- Blood Pressure Simulator Adapter Cable (700095-001)
- Dual BP cable

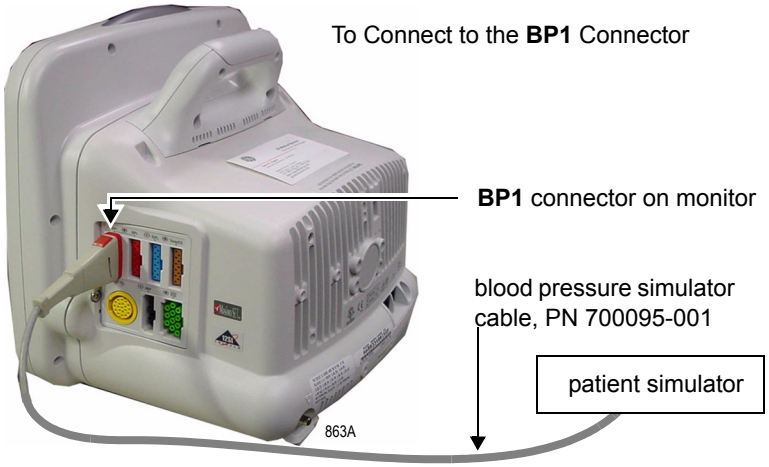
The invasive blood pressure (BP) tests provide a method of verification for both BP connectors (**BP1, BP2**, **BP1/3** and **BP2/4**) of a patient monitor equipped with this optional function. Follow these steps:

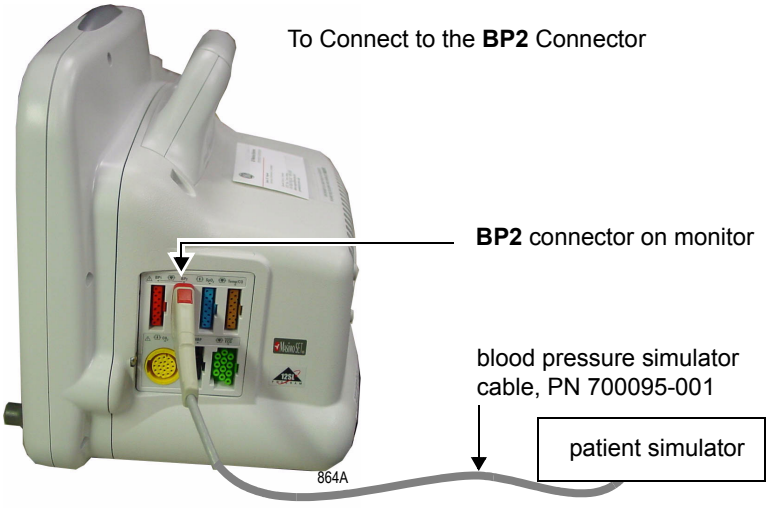
1. Set up the patient simulator as follows:
   - Blood pressure (BP) polarity – POS, if required.
   - BP output – 0 mmHg.
   - BP transducer output – 5 µVolts.

BP Connector Tests

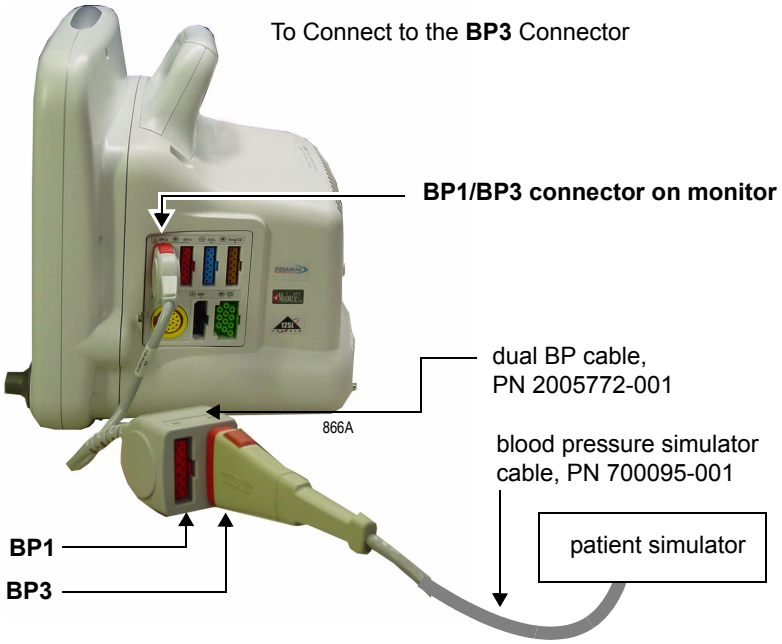
1. Connect the BP simulator cable from the BLOOD PRESSURE 1 - 120/80 connector of the patient simulator to the enabled **BP** connectors you will be testing on the patient monitor.

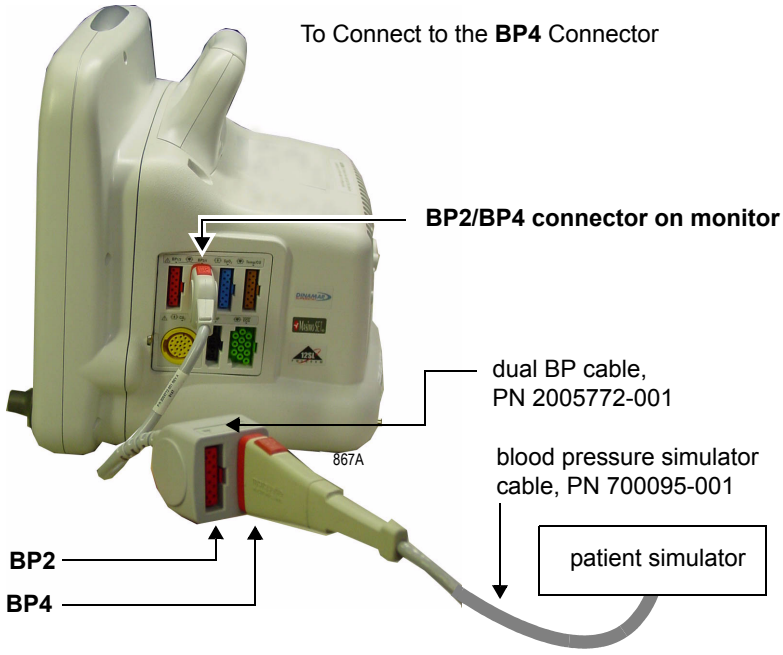
   a. To connect to the **BP1** or the **BP2** connector, see the pictures below.





b. To connect to the **BP3** or **BP4** connectors, see the pictures below.





2. Verify the BP parameter window, waveform label, corresponding graticules, and waveform appear on the patient monitor display, along with a BP waveform requiring zero reference.
3. Press the **ZERO ALL** (**FUNCTION**) key on the front panel of the patient monitor to zero-reference the BP waveform.
4. Change the patient simulator BP output to 200 mmHg (240 if using the Marq II or MarqIII).

5. Observe a reading of 200/200 (200) ± 4 mmHg (or 240 ± 4 mmHg if using the Marq II or MarqIII) in the BP parameter window on the patient monitor display.
6. Change the patient simulator BP output to WAVE or to a 120/80 wave form (simulated BP waveform).
7. Observe a distortion-free BP waveform and a reading of approximately 120/80 (93) in the BP parameter window on the patient monitor display.
8. Disconnect the BP simulator cable from the **BP** connector of the patient monitor.
9. Complete steps for each enabled **BP** connector.

Pulse Oximetry Tests for GE Ohmeda SPO2 Oximeter

Equipment

Use the following equipment for these tests:

- GEMS-IT SpO_2 Simulator (408610-001 or equivalent).

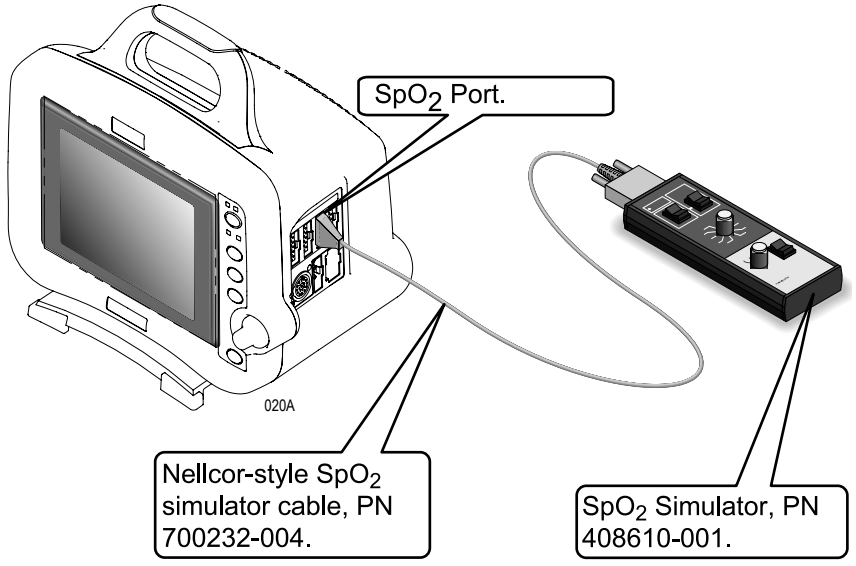
  NOTE

  The GEMS-IT SPO_2 Simulator is only compatible with the GEMS-IT SPO_2 parameter.

- GEMS-IT SpO_2 Simulator Cable (700232-004 or equivalent)
- Clinical Dynamics' SmartSAT™ Pulse Oximetry Analyzer (or equivalent). Contact Clinical Dynamics for appropriate Nellcor or Masimo SET SpO_2 adapter cable. However, the simulator comes standard with a Nellcor SpO_2 cable.
- Fluke Biomedical's Index 2_{XL} SpO_2 Simulator (or equivalent). Uses either a Masimo SET or Nellcor SpO_2 finger probe patient cable.

Procedure

1. Set the pulse oximetry (SpO_2) simulator power switch to the OFF position.
2. Connect the Nellcor-style SpO_2 simulator cable between the SpO_2 connector of the patient monitor and the SpO_2 simulator.



3. Set the simulator as follows:
   a. Set the **MODE** to **NELLCOR**.
   b. Set the SpO_2% to **99**.
   c. Set the PRR to **100** beats/min.
   d. Turn the power **ON**.

4. Verify that the following are displayed at the patient monitor:
   - A sinusoidal waveform with an SpO_2 label.
   - An SpO_2% reading between 97 – 100% (97 and 102%).
   - A PRR reading between 97 and 103 beats per minute (it might be necessary to turn the SpO_2 ON).

5. Test the accuracy of these SPO_2% settings.

Accuracy of SpO_2 Settings	
Simulator Setting	**Displayed SpO_2 Value**
99% (Both types)	97 – 100% (97 – 102%)
80.3% (84%)	78 – 82% (81 – 87%)
49.7 (63%)	48 – 52% (61 – 65%)

6. Test the accuracy of these PPR settings:

Accuracy of PPR Settings	
Simulator Setting	**Displayed PPR Value**
70	68 – 72
100	97 – 103
160	156 – 164

7. Return the simulator to these conditions:
   - Set the SpO_2% to **99**.
   - Set the PPR to **100** beats/min.

8. Press the **NOISE TEST** button **ON** the simulator for 30 seconds.
9. Make sure the patient monitor still displays an SpO_2 value between 97 and 100% (97 and 102%), or an interference detection message is displayed.
10. Turn the simulator **OFF**.
11. Disconnect the simulator cable from the device under test.

Pulse Oximetry Tests for Masimo SET SPO2

Equipment

Use the following equipment for these tests:

- Masimo SpO_2 Test Kit (2021087-001). Includes Masimo Tester and SP02 Sensor Adapter Cable.

  NOTE

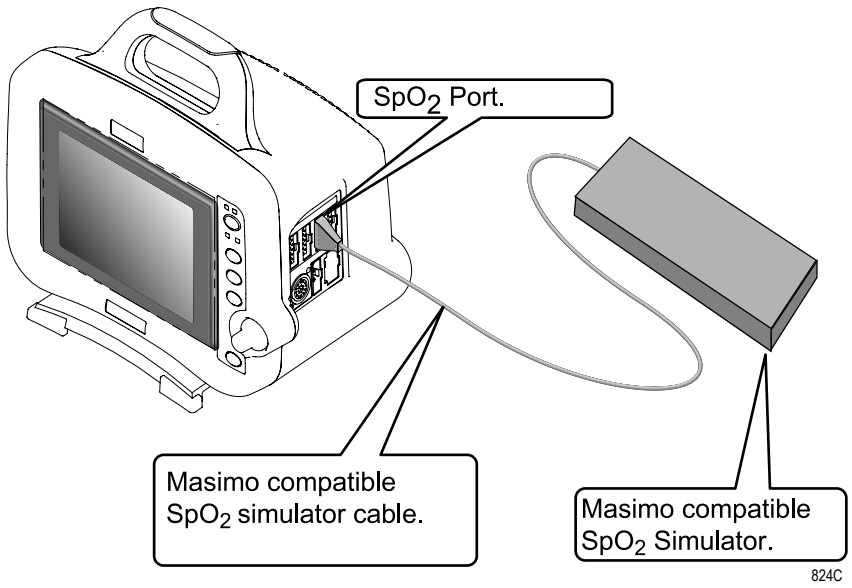
  The Masimo Tester is intended for use only with Masimo instruments or instruments containing Masimo SET oximetry with standard Masimo PC Series patient cable connectors. See the Masimo "Directions for Use" that came with the Tester for more information

  The PPR and SP02 values for the Masimo Tester must be within these limits: Peripheral pulse rate: 61 bpm ± 1 bpm; and SPO2 value: 81% ± 3%.

- Clinical Dynamics' SmartSAT™ Pulse Oximetry Analyzer (or equivalent). Contact Clinical Dynamics for appropriate Nellcor or Masimo SET SpO_2 adapter cable. However, the simulator comes standard with a Nellcor SpO_2 cable.
- Fluke Biomedical's Index 2_{XL} SpO_2 Simulator (or equivalent). Uses either a Masimo SET or Nellcor SpO_2 finger probe patient cable.

Procedures

1. Connect the Masimo-style SPO2 simulator cable between the SPO2 connector of the patient monitor and the SPO2 simulator.



NOTE

Do not connect the simulator to an AC power supply for these tests. Operate the simulator on battery power.

2. Set the simulator as follows:
   a. Turn the patient monitor on and the simulator power **ON**.
   b. Set the simulator to be compatible with Masimo SET SPO2. For specific set up options, see the documentation provided with the patient simulator.
   c. Set the SPO2 % to **81**.
   d. Set the PRR to **61** beats/minute.
3. Verify the following are displayed at the patient monitor: (It might be necessary to turn the SPO2 parameter on.)
   - A waveform with an SpO_2 label.
   - An SPO2 % reading between **78 - 84**%.
   - A PRR reading between **58** and **64** beats per minute.
4. Create an alarm condition by setting the SPO2 low limit to **90**%.
5. Make sure the SPO2 % value on the patient monitor flashes, and it sounds an alarm.
6. Return the low limit to the original value.
7. Disconnect the simulator cable from the module.

Pulse Oximetry Tests for Nellcor OxiMax SPO2

Equipment

Use the following equipment for these tests:

- Nellcor SRC-MAX SpO_2 Simulator (2007650-002).

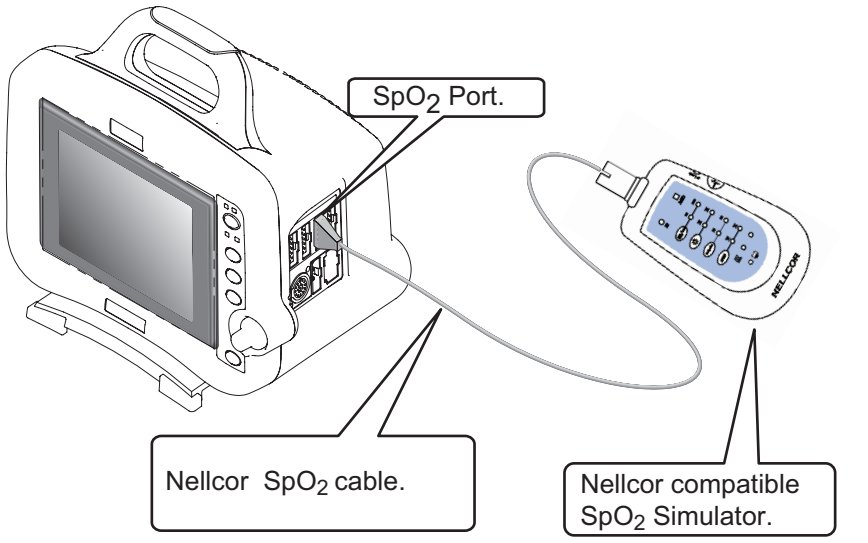
  NOTE

  The Nellcor SRC-MAX SPO_2 Simulator is only compatible with the Nellcor SPO_2 parameter.

- Clinical Dynamics' SmartSAT™ Pulse Oximetry Analyzer (or equivalent). Contact Clinical Dynamics for appropriate Nellcor or Masimo SET SpO_2 adapter cable. However, the simulator comes standard with a Nellcor SpO_2 cable.
- Fluke Biomedical's Index 2_{XL} SpO_2 Simulator (or equivalent). Uses either a Masimo SET or Nellcor SpO_2 finger probe patient cable.

Procedures

1. Verify that 2 AA alkaline batteries are installed in the SRC-MAX Nellcor Pulse Oximetry functional tester.
2. Connect the SRC-MAX Nellcor Pulse Oximetry functional tester to the 9-pin end of sensor connector from the DASH. Make sure the DASH is powered.



3. Verify that the IR LED and RED LED drive indicators are both lit on the SRC-MAX.

4. Verify the SRC-MAX default indicators are set as follows:
   - HEART RATE = 60 bpm
   - LIGHT = LOW
   - %SpO2 = 75
   - MODULATION = LOW

   Allow the DASH a few seconds to obtain a steady reading.

5. Verify the following SpO2 readings on the DASH for saturation and pulse rate:
   - Saturation (%): 75 ±2
   - Rate (bpm): 60 ± 2

6. Press and release the **HEART RATE** switch and verify the SRC-MAX default indicators are lit as follows:
   - HEART RATE = 200 bpm
   - LIGHT = LOW
   - %SpO2 = 75
   - MODULATION = LOW

   Allow the DASH a few seconds to obtain a steady reading.

7. Verify the following SpO2 readings on the DASH for saturation and pulse rate:
   - Saturation (%): 75 ±2
   - Rate (bpm): 200 ±3% (194 to 206)

8. Press and release the **LIGHT** switch and verify the SRC-MAX default indicators are lit as follows:
   - HEART RATE = 200 bpm
   - LIGHT = HIGH
   - %SpO2 = 75
   - MODULATION = LOW

   Allow the DASH a few seconds to obtain a steady reading.

9. Verify the following SpO2 readings on the DASH for saturation and pulse rate:
   - -Saturation (%): 75 ±2
   - -Rate (bpm): 200 ±3% (194 to 206)

10. Press and release the %SpO2 switch and verify the SRC-MAX default indicators are lit as follows:
    - HEART RATE = 200 bpm
    - LIGHT = HIGH
    - %SpO2 = 90
    - MODULATION = LOW

Allow the DASH a few seconds to obtain a steady reading.

11. Verify the following SpO2 readings on the DASH for saturation and pulse rate:
    - Saturation (%): 90 ±2
    - Rate (bpm): 200 ±3% (194 to 206)

12. Press and release the **MODULATION** switch and verify the SRC-MAX default indicators are lit as follows:
    - HEART RATE = 200 bpm
    - LIGHT = HIGH
    - %SpO2 = 90
    - MODULATION = HIGH

    Allow the DASH a few seconds to obtain a steady reading.

13. Verify the following SpO2 readings on the patient monitor for saturation and pulse rate:
    - Saturation (%): 90 ±2
    - Rate (bpm): 200 ±3% (194 to 206)

Noninvasive Blood Pressure Tests

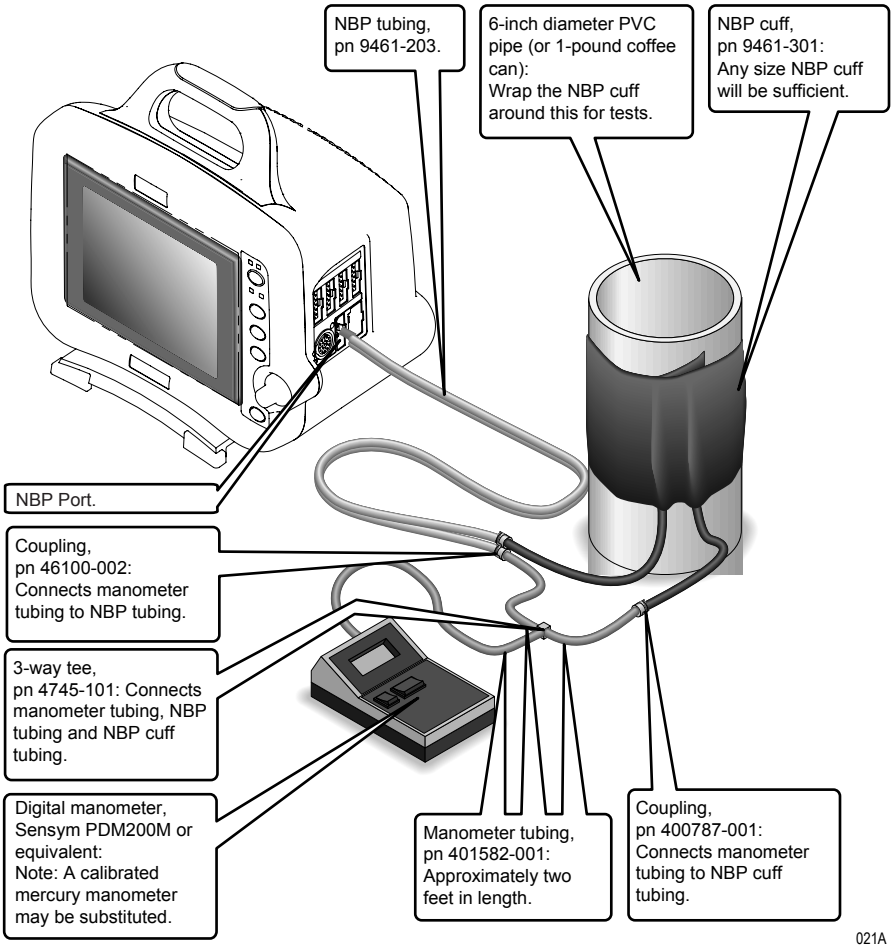
Equipment

Use the following equipment for these tests:

- NBP cuff coupling (400787-001)
- NBP hose coupling (46100-002)
- NBP tee (4745-101)
- NBP tubing 2 feet (401582-001)
- Manometer: mercury, digital (Sensym PDM200M – no longer available for ordering, Meriam Instrument Smart Manometer Model 350 DM2000, or equivalent)
- NBP tube (414873-001)
- NBP cuff (9461-301)
- Pipe: PVC

Procedures

1. Attach the digital manometer, noninvasive blood pressure (NBP) cuff, tees and tubing, as shown in the illustration below, to the NBP connector of the patient monitor.


NBP tubing, pn 9461-203.
6-inch diameter PVC pipe (or 1-pound coffee can): Wrap the NBP cuff around this for tests.
NBP cuff, pn 9461-301: Any size NBP cuff will be sufficient.
NBP Port.
Coupling, pn 46100-002: Connects manometer tubing to NBP tubing.
3-way tee, pn 4745-101: Connects manometer tubing, NBP tubing and NBP cuff tubing.
Digital manometer, Sensym PDM200M or equivalent: Note: A calibrated mercury manometer may be substituted.
Manometer tubing, pn 401582-001: Approximately two feet in length.
Coupling, pn 400787-001: Connects manometer tubing to NBP cuff tubing.
021A

2. Set the digital manometer power switch to the on position.
3. Set the digital manometer range switch to 1000 mmHg.

Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu.

1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select *CALIBRATE > CALIBRATE NBP > CHECK CAL OFF > START.*

   The text on the menu item changes from *CHECK CAL OFF* to *CHECK CAL IN PROGRESS.*

Verify the readings in the NBP parameter window on the patient monitor display and readings on the digital manometer are equal (± 1 mmHg) for at least one full minute. If the readings are not equal for at least one full minute, the NBP circuit requires calibration. See "NBP Calibration" on page 8-38.

4. Select *CHECK CAL IN PROGRESS > STOP*.

   The pneumatic control circuit of the patient monitor vents air pressure in the pneumatic circuit of the patient monitor to atmosphere and causes the NBP cuff to deflate.

5. Remove the NBP test setup apparatus from the patient monitor. The NBP tests are complete.

NBP Calibration

The overall accuracy of noninvasive blood pressure (NBP) readings by the patient monitor depend on the following:

- the zero pressure reading, and
- the voltage span of the NBP sensor in the patient monitor.

This procedure provides a method of verifying these items are accurate and also checks the NBP pneumatic circuit plumbing for leaks.

WARNING
When the NBP cuff is used in this procedure, it must be tightly wrapped around a rigid cylinder or pipe. DO NOT put the NBP cuff around a human arm during the calibration procedures due to the potential for injury.

Calibration Procedure

Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu.

1. Select *MORE MENUS-> MONITOR SETUP-> SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select *CALIBRATE-> CALIBRATE NBP-> CAL ZERO OFF-> START*.
4. The text on the menu item changes from Cal Zero Off to Cal Zero In Progress.

   When the process is complete, the menu item shows that it is *OFF* again.

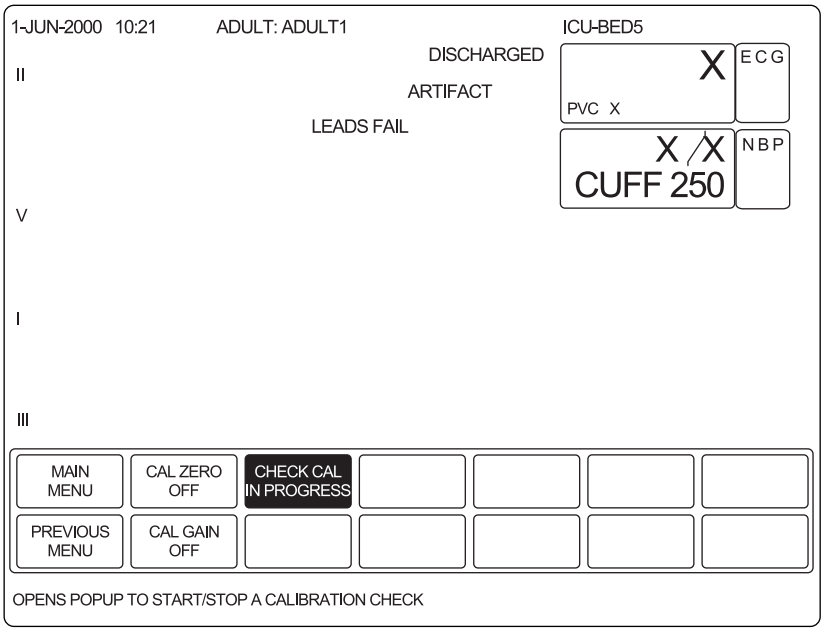
Gain Calibration Test

NOTE

To proceed with the Gain Calibration Test, setup the patient monitor and test equipment following the guidelines in the NBP Checkout Procedure,"Checkout Procedures" on page 8-17.

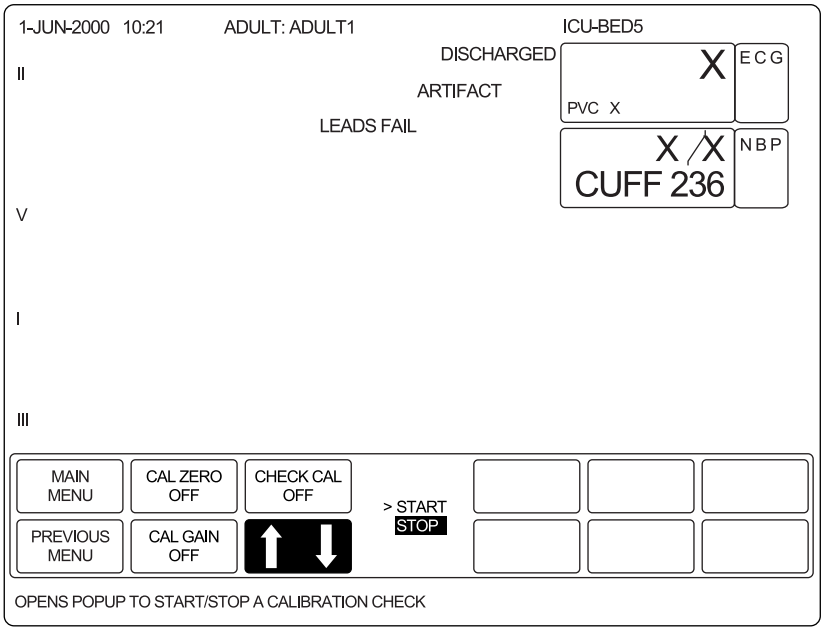
1. Connect a cuff and manometer to the patient monitor.
2. Turn the digital manometer on and adjust the range switch to 1000 mmHg.
3. Select *CAL GAIN OFF-> CAL GAIN OFF-> START*.
4. The second line of text on the Cal Gain menu item changes from Cal Gain Holding to Cal Gain Inflating. The patient monitor starts pumping up the pressure bulb or cuff—the audible whirring sound of the NBP pump motors occurs and an increase in displayed pressures on both the patient monitor and the manometer can be observed.
5. The pump shuts off at about 250 mmHg, and the pressure drops slowly to about 240 mmHg before stabilizing. The second line of text on the Cal Gain menu item changes from Inflating back to Holding. If the pressure continues to drop at a rate of 1 mmHg or more for every five seconds, there is a leak in the NBP plumbing. If there is a leak in the NBP plumbing, repair it and restart this calibration procedure.
6. Select *ENTER CAL PRESSURE* and use the **Trim Knob** control to select a pressure value that is 1 mmHg lower than the current manometer reading. When the manometer falls to exactly the value that you selected in the pop-up window, press the **Trim Knob** control to enter the value.
7. Select *CHECK CAL OFF-> START*.

8. The text on the menu item changes from Check Cal Off to Check Cal In Progress. Verify the pressure readings (shown as Cuff in the NBP parameter box) on the patient monitor and manometer are equal (± 1 mmHg) for AT LEAST one full minute.



028B

9. Select *CHECK CAL IN PROGRESS -> STOP*. The patient monitor automatically releases pneumatic pressure in the entire plumbing circuit.



029B

10. Unplug the patient monitor from AC power source and remove the test apparatus from the patient monitor.

Analog Output and Defibrillator Synchronization Tests

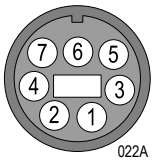
Equipment

Use the following equipment for these tests:

- Oscilloscope
- 5.5 digit precision voltmeter (HP34401A, or equivalent)
- Analog output cable (2000633-001)

Setup

1. Use the figure below as a reference for connecting the oscilloscope to the **DEFIB SYNC** connector, located on the back panel of the patient monitor, for performing these tests.



022A

2. Test the ECG, Arterial BP, and Marker Out signals from the **DEFIB SYNC** connector. They should closely resemble the waveforms in the figures below.

DEFIB Sync Connector: ECG

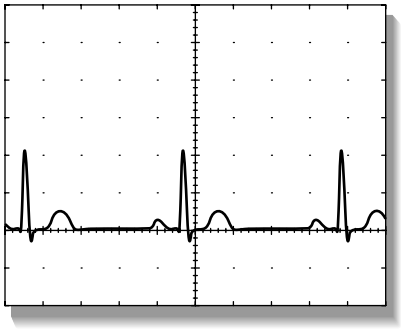
Signal Pin:—7

Ground Pin:—3

Probe Type:—x10

Time/Division:—0.2S

Volts/Division:—0.5V


023A

DEFIB Sync Connector: Arterial BP

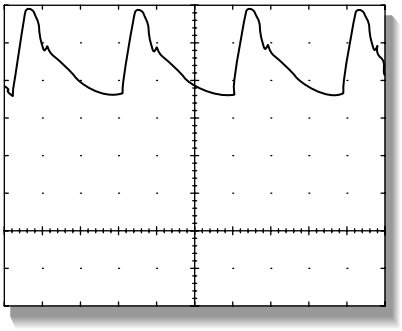
Signal Pin:—6

Ground Pin:—5

Probe Type:—x10

Time/Division:—0.2S

Volts/Division:—0.2V


024A

There are two Marker Out traces shown below. The upper Marker Out figure references the frequency aspects of the signal. The lower Marker Out figure references the pulse width aspects of the signal.

NOTE

The Marker Out amplitude and the pulse width are configured in the boot menu as described in the configuration chapter. The following two graphs indicate an amplitude of 5V and a pulse width of 10ms.

DEFIB Sync Connector: Marker Out (Frequency)

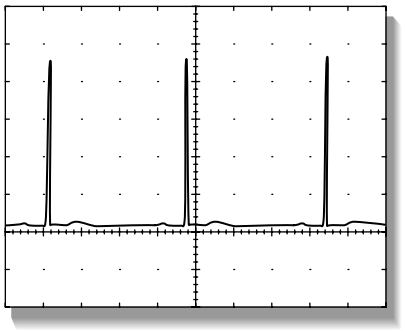
Signal Pin:—1

Ground Pin:—4

Probe Type:—x10

Time/Division:—0.2S

Volts/Division:—1V



025A

DEFIB Sync Connector: Marker Out (Pulse Width)

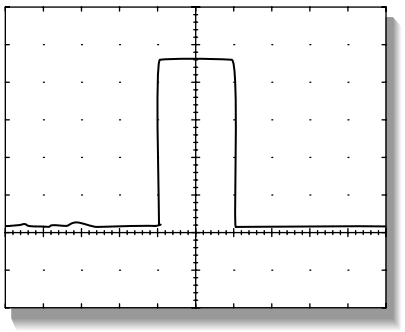
Signal Pin:—1

Ground Pin:—4

Probe Type:—x10

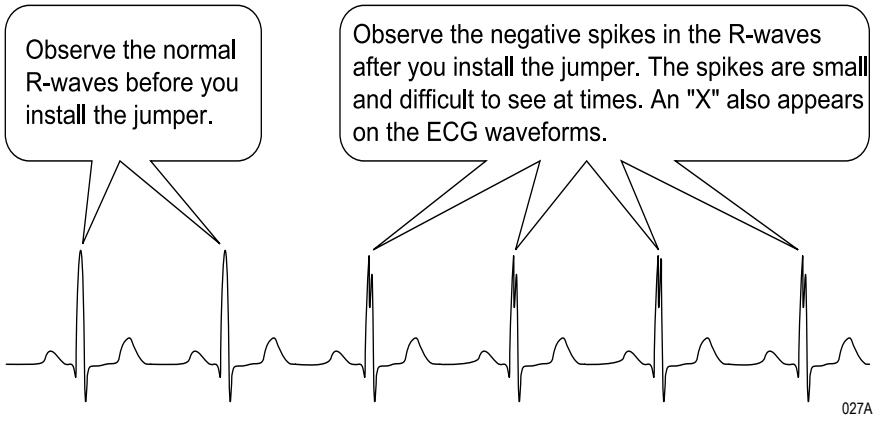
Time/Division:—5mS

Volts/Division:—1V



026A

3. Attach a jumper wire between pin-1 (Marker Out) and pin-2 (Marker In) of the **DEFIB SYNC** connector located on the back of the patient monitor. Verify negative spikes in each of the QRS Complex (ECG waveform) R-Waves on the patient monitor display, similar to those shown in the illustration below.


Observe the normal R-waves before you install the jumper.
Observe the negative spikes in the R-waves after you install the jumper. The spikes are small and difficult to see at times. An "X" also appears on the ECG waveforms.
027A

4. Remove the jumper wire installed in the previous step, from the **DEFIB SYNC** connector. This completes the defibrillator synchronization tests.

ECG or BP Calibration

To complete the ECG or BP calibration, connect a voltmeter to the patient monitor.

1. Attach the analog output cable (pn 2000633-001) to the patient monitor.
2. Connect a 5.5 digit precision voltmeter (such as HP34401A, or equivalent) to the port pin to be calibrated (If ECG: Pin 7 = ECG signal, Pin 3 = ground. If BP: Pin 6 = BP, Pin 5 = ground.).

3. Access the patient monitor's Service Mode
4. Calibrate the ECG or the BP parameters as follows.

ECG Calibration

Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu.

1. Select *MORE MENUS-> MONITOR SETUP-> SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select *CALIBRATE-> CAL ECG ANALOG OUT-> SET ECG LOW.*

4. Adjust the count for –9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
5. Select *SET ECG HIGH*.
6. Adjust the count for +9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
7. Select *SET ECG ZERO*.

   Adjust the count for 0.0 V ± 5 mV on the meter and press the **Trim Knob** control.
8. Select *CONFIRM ECG CAL* to confirm or abort the calibration

BP Calibration

Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu.

1. Select *MORE MENUS-> MONITOR SETUP-> SERVICE MODE.*
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select *CALIBRATE-> CAL BP ANALOG OUT-> SET BP LOW*.
4. Adjust the count for –9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
5. Select *SET BP HIGH*.
6. Adjust the count for +9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
7. Select *SET BP ZERO*. Adjust the count for 0.0 V ± 5 mV on the meter and press the **Trim Knob** control.
8. Select *CONFIRM BP CAL* to confirm or abort the calibration

End-tidal CO_2 Test (option)

To verify the mainstream end-tidal CO2, refer to the CO2 chapter in the Dash 3000/4000/5000 Patient Monitor Operator's Manual. This test requires you perform a zero and reference check by using the sample cells provided on the end-tidal CO2 cable.

For instructions on verifying sidestream end-tidal CO2 and setting the sample line to zero, refer to the CO2 module operator instructions.

Battery Tests

1. Disconnect the power cord plug from the power outlet.
2. Verify the **BATTERY** front panel indicator lights. This indicates operation from the patient monitor's battery power.
3. Setup the patient simulator as follows:
   - ECG heart rate – 80 bpm,
   - ECG amplitude – 1.0 mV,
   - 5-lead patient cable attached.
4. Observe the following:
   - ECG Lead II is displayed and is noise-free,
   - Heart rate of 80 ±1 bpm is displayed,
   - With *QRS VOLUME* enabled, an audible tone sounds with each R-Wave.
5. Verify all six ECG leads are selectable for display on the patient monitor.
6. Connect the power cord plug to the power outlet.
7. Verify the AC front panel indicator lights. This indicates the patient monitor is operating from power outlet (AC) power.
8. Verify the **CHARGING STATUS** front panel indicator lights for a few minutes.
   - An amber glow indicates the patient monitor battery is charging.
   - A green glow indicates the patient monitor batteries are fully charged.

Graph/Print Tests

Communication Confirmation

Confirm communication across the network as follows.

1. Admit and generate a waveform at the patient monitor with a simulator.
2. Press **Print** and observe graph output at chosen locations.

Test Pattern

Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu.

1. Select *MORE MENUS* > *MONITOR SETUP* > *SERVICE MODE*.
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select *PRINT* (or *GRAPH*) *TEST PATTERN* > *START*.

4. Verify the following:
   - Fonts
   - Shading
   - Triangle Pattern
   - No missing dots
5. Select *PRINT* (or *GRAPH*) *TEST PATTERN > STOP*.

Graph Speed

Using the **Trim Knob** control, access the Graph Setup menu starting from the Main Menu.

1. Select *MORE MENUS > MONITOR SETUP > PRINT* (or *GRAPH*) *SETUP*.
2. Select *SPEED:25* (default).
3. Verify that all eight speeds work.

Display Test

1. Hold the **NBP Auto** and the **ZERO ALL** keys and press the **Trim Knob** control at the SAME time.
2. Release the **Trim Knob** control immediately.
3. Continue holding the **NBP Auto** and the **ZERO ALL** keys.
4. Select "Video Test Screens."
5. Test all screens:
   - White Screen.
   - Red Screen.
   - Blue Screen.
   - Green Screen.
   - Vertical Bars.

Speaker Test

1. Change the alarm volume of the patient monitor to 100%.
2. Verify the speaker volume of the patient monitor changes accordingly.
3. Return the volume of the patient monitor to the level it was previously set to, before you changed it for this test.

Network Test (option)

1. Verify that the patient monitor is connected to the Unity Network MC (Mission Critical) network.

   NOTE
   When the patient monitor is connected to a docking station, verify the docking station is connected to the Unity Network MC network.

   NOTE
   When the patient monitor is connected to a docking station, the patient monitor's network port is disabled. Only the docking station's network port is enabled at this time.

2. Select *VIEW OTHER PATIENTS*.
3. Select *SELECT ANOTHER CARE UNIT*.
4. Verify that you can see at least one care unit.
5. Select a care unit.
6. Select *SELECT A BED TO VIEW*.
7. Select a bed.
8. Verify that the patient window appears on the patient monitor's split-screen.

Remote Control Test (option)

1. Verify the remote control is connected into an Autoport to M-Port adapter and is inserted into the **Aux** connector.
2. Select *MORE MENUS > MONITOR SETUP > REVISION AND ID*.
3. Select *NEXT* from the popup menu to display the port connectors.
4. Verify the Remote Control label appears after the appropriate port and the software version for the remote control is 1A.
5. Press each remote control key and verify a beep tone sounds at the patient monitor.

BISx Test (option)

Before performing these procedures, complete the following Electrical Safety tests for the BISx module.

- "Ground (Earth) Wire Leakage Current Tests" on page 8-10
- "BISx Patient (Source) Leakage Current Test" on page 8-14
- "BISx Patient (Sink) Leakage Current Test" on page 8-16

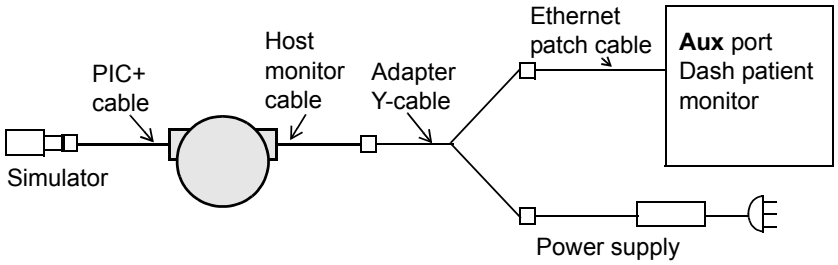
Equipment

Use the following equipment for this test:

- BISx with integrated host patient monitor cable and Patient Interface Cable (PIC+)
- BISx adapter Y-cable assembly 2026830-001
- Ethernet patch cable 2011129-001
- Power supply with power cord
- Sensor Plus Simulator (2007695-001 or equivalent)

Procedure

1. See the diagram below and connect the BISx as follows:.



   a. Connect the BISx host patient monitor cable to the BISx adapter Y-cable assembly.

   b. Connect one end of the Y to the power supply and the other to the Ethernet patch cable.

   c. Connect the Ethernet patch cable to the **Aux** port connector on the Dash patient monitor.

   d. Connect the power supply to an AC power source.

   The BIS parameter window appears. The prompt, *CONNECT SENSOR* displays in the parameter window.

2. Connect the Patient Interface Cable (PIC) to the Sensor Plus Simulator.

   The message *SENSOR CHECK IN PROCESS* displays in the parameter window.

3. Select the BIS parameter block to open the BIS parameter menu.

4. From the BIS parameter menu, select the S*ENSOR CHECK* menu option. An information window opens with the impedance data. For example:

LEAD	IMPEDANCE	STATUS
1	4.8	PASS
2	14.0	PASS
3	2.3	PASS
4	3.3	PASS

5. Verify that the impedance values displayed in the information window fall within the range shown below.

Electrode #	Acceptance Range in Kohms
1	4—6
2	8—17
3	2—4
4	3—5

Wireless LAN Test (option)

Purpose

These procedures check the patient monitor for wireless communication. While moving a roll-stand with a wireless patient monitor from edge to edge of the predetermined wireless network coverage area, check for the following at the edges of the wireless network:

- the *SIGNAL QUALITY* is equal to or greater than 20,
- the *TRANSMIT RATE* is equal to or greater than 5.5, and
- a constant waveform from a stationary wireless/wired patient monitor displays without any loss of waveform.

NOTE

This is a verification of the patient monitor and must not substitute a professional site survey, installation and verification of the areas designed for the wireless network. The connectivity and coverage of the wireless network is verified through the *SIGNAL QUALITY* status and *TRANSMIT RATE* status in the wireless patient monitor.

Equipment

Use the following equipment and information for this test:

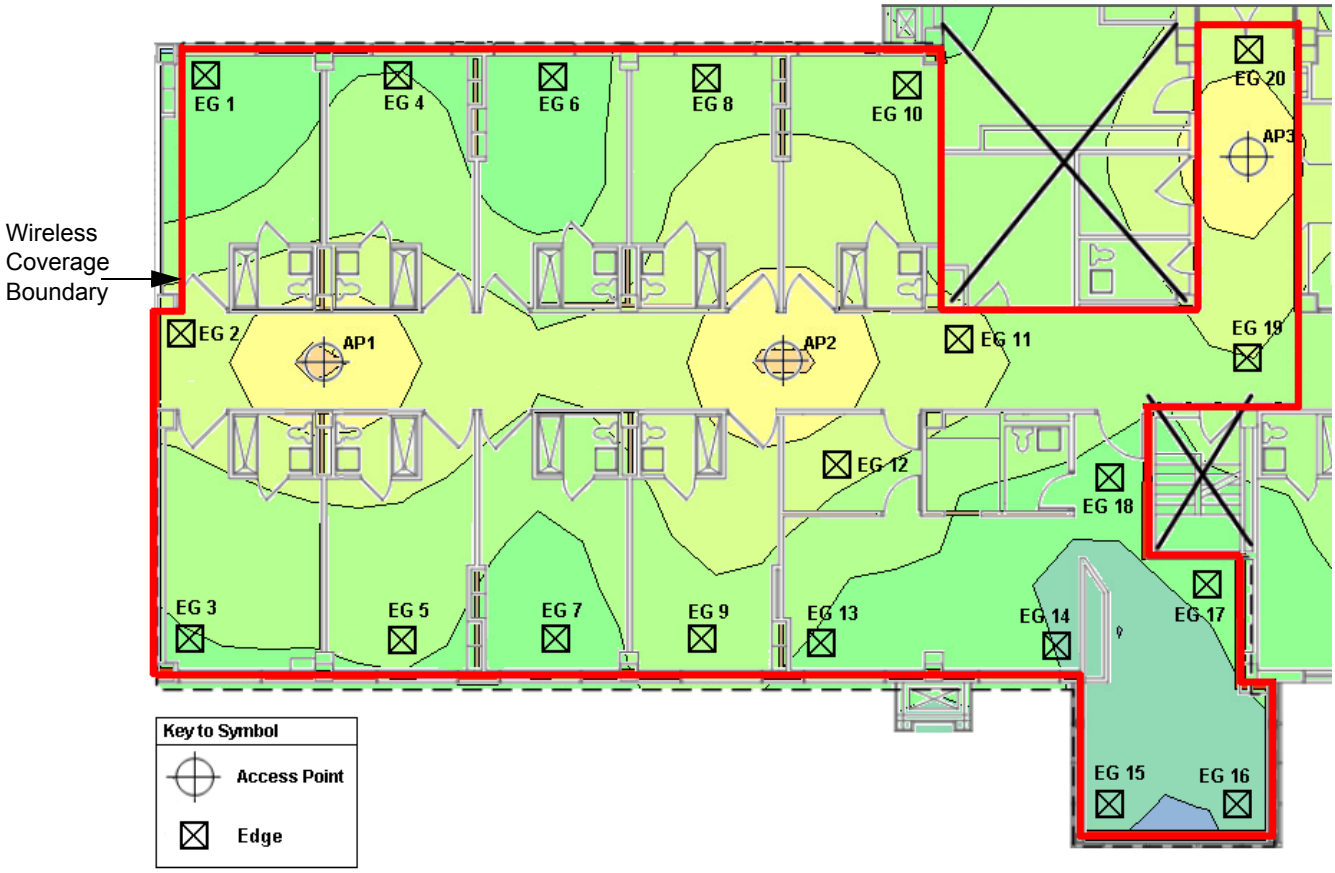
- Battery powered wireless Dash patient monitor
- Roll-stand
- Stationary wireless/wired patient monitor
- MarqI, MarqII, or MarqIII patient simulator or an equivalent ECG patient simulator.
- Contact the hospital IT department to get
  - access point settings for SSID and SECURITY, and
  - wireless network coverage area.

Procedures

1. Connect the patient simulator to the stationary wireless/wired patient monitor and generate a waveform.
2. Admit the stationary wireless/wired patient monitor to the Unity Network MC Network.
3. Place the battery powered wireless Dash patient monitor on the roll-stand and configure it to communicate with the wireless network as follows:
   a. On the patient monitor, select *MORE MENU> MONITOR SETUP > SERVICE MODE.*
   b. Enter the password.
   c. Select *MONITOR SETTINGS> CONFIGURE WIRELESS LAN.*
   d. Ensure that the *SSID* and *SECURITY* match the wireless

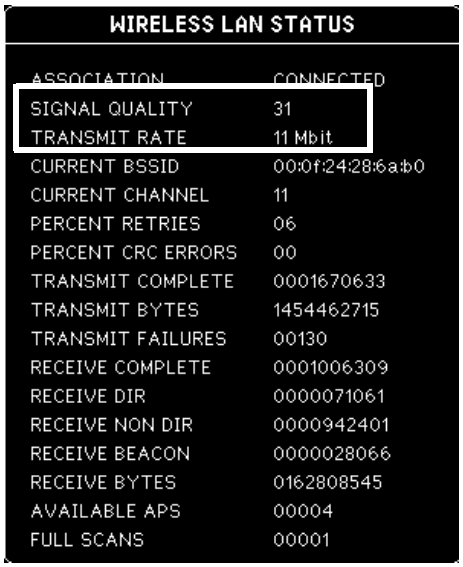
network.

4. The diagram below is an example of a predetermined coverage area of the wireless network. Roll the stand to the first edge (EG1).



5. At the battery powered patient monitor, select *MONITOR SETUP* > *SERVICE MODE*.
6. Enter the password.

7. Select *MONITOR SETTINGS > WIRELESS LAN STATUS*.



8. Verify that
   a. the *SIGNAL QUALITY* status is equal to or greater than 20, and
   b. the *TRANSMIT RATE* status is equal to or greater than 5.5.

   If the *SIGNAL QUALITY* is less than 20 and/or the *TRANSMIT RATE* is less than 5.5, contact the hospital IT department to check for radio interference and verify that the access point's radio transmission is operating optimally.
9. Close the *WIRELESS LAN STATUS* window.
10. Configure the battery powered patient monitor to view the stationary patient monitor's waveform as follows:
    a. On the patient monitor, select *MORE MENU> VIEW OTHER PATIENTS > SELECT ANOTHER CARE UNIT*.
    b. Select the appropriate unit.
    c. Select *SELECT A BED TO VIEW*.
    d. Select the appropriate bed.
11. Verify that the waveform displays without any losses.
12. Go to the next edge while monitoring the waveform.
13. Verify that the waveform displays without any losses.
14. Repeat steps 5 through 13 for all edges identified.

    If a waveform gap or loss was spotted on the display, contact the hospital IT department to check for radio interference and verify that the access point's radio transmission is operating optimally.

NOTE

If you walk outside the coverage area there is no alarm or displayed indication that you have done so.

Dash Port Docking Station Test (option)

Electrical Safety Tests

When the patient monitor is connected to the docking station, perform ALL the tests described in "Electrical Safety Tests" starting on page 8-5.

Operation

Complete the Checkout Procedures located in the Dash Port Docking Station Service Manual.

RAC 2A Module Housing Peripheral Device Test (option)

Electrical Safety Tests

Because the RAC 2A module housing has a separate power supply, perform electrical safety tests separate from the patient monitor.

Refer to the "Electrical Safety Tests" section of this chapter and complete the following tests.

1. Power Outlet Test
2. Ground (earth) Continuity Test,
3. Ground (earth) Wire Leakage Tests, and
4. Enclosure Leakage Current Test.

Operation

Complete the "Maintenance Schedule" procedures found in the "RAC 2A Module Housing Service Manual."

Data Acquisition Tests

ECG Functions

1. Connect the Multifunction Microsimulator (pn MARQII or MARQIII) and appropriate patient cables, to the ECG connector of the patient monitor. Turn the patient monitor and the patient simulator on.
2. Set the patient monitor to display leads I, II, III, and V simultaneously:
   a. From the main menu, select *DISPLAY OPTIONS*.
   b. Make sure the Display menu item shows Individual plus six waveforms. If it shows Full, change it to Individual.
   c. Select *WAVEFORMS ON/OFF* from the menu.
   d. Set the displayed waveforms for the following ECG leads:

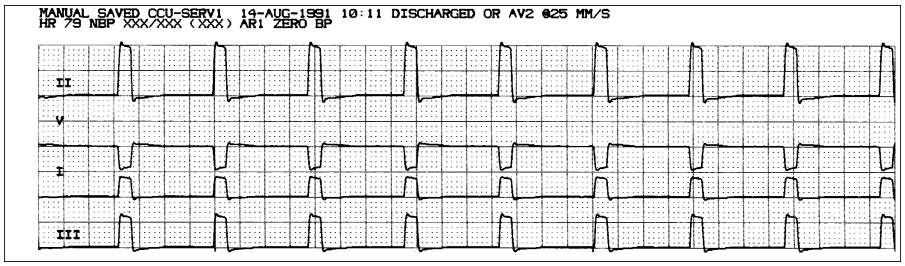
ECG 1	WAVEFORM 2	WAVEFORM 3	WAVEFORM 4
LEAD II	LEAD V	LEAD I	LEAD III

3. Set the patient simulator to output calibration (cal) pulses at 1.0 mV.
4. Measure the cal pulse (⎍⎍) amplitude. These should be (+/–20%):
   - Lead I:0.5 mV
   - Lead II:1 mV
   - Lead III:0.5 mV
   - Lead V:–0.5 mV
5. It may be necessary to run a graph to accurately measure the cal pulses. Perform these steps to graph all four waveforms.
   a. From the main menu, select *GRAPH & ALARMS*.
   b. Select *GRAPH CONTROL* from the menu.
   c. Set the graphed waveforms for the following ECG leads:

ECG 1	WAVEFORM 2	WAVEFORM 3	WAVEFORM 4
LEAD II	LEAD V	LEAD I	LEAD III

   d. Press the **Graph Go/Stop** (**Print** on Dash 5000) front panel control on the patient monitor to start and stop a manual graph.

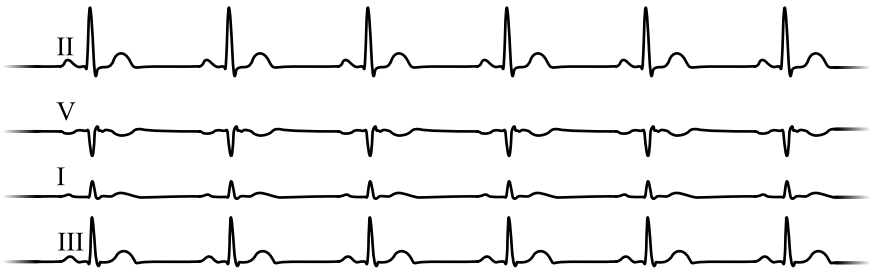
e. Compare the printed graph with the sample shown below.



031A

f. Change the patient simulator output from cal pulses to an 80-bpm ECG waveform.

The displayed ECG waveforms should be similar to those shown in the figure below.



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If this is the case, the ECG functions of the acquisition PCB, as well as communication between the acquisition and processor PCBs function as designed.

ECG Waveforms Display Incorrectly

1. If the calibration pulses are NOT correct, test the patient simulator using a working patient monitor. If the patient simulator functions as designed, calibrate the acquisition PCB. Refer to "ECG Tests" on page 8-19
2. If displayed ECG waveforms contain a significant amount of noise, check the ECG patient cables.

535A

3. Test the patient simulator and ECG patient cables on a working patient monitor to verify the ECG signal.
4. If the ECG signal, patient simulator and ECG patient cables are good, the acquisition PCB is suspect and you need to replace it.

ECG Waveforms Do Not Display At All

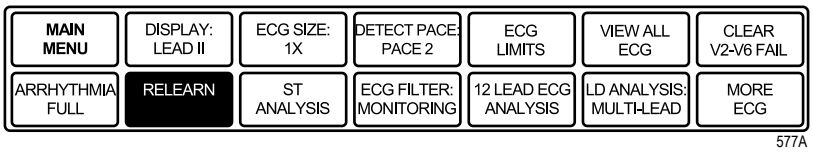
1. Test the ECG patient cables on a working patient monitor.
2. Test the patient simulator on a working patient monitor.
3. Swap the acquisition PCB into a working patient monitor. If the symptoms follow the PCB into the working patient monitor, replace the acquisition PCB.
4. If none of these first three steps provide any results, swap the processor PCB and/or power supply PCB into a working patient monitor.

Lead Fail Functions

1. With the patient monitor displaying leads I, II, III, and V from the patient simulator, remove the RA leadwire from the patient simulator.
2. The patient monitor should display a warning of a RA FAIL message. Lead fail detection functions properly if this is the case. Lead fail detection does not function properly if this is NOT the case. The acquisition PCB is suspect. Swap the PCB with a working patient monitor to verify the malfunction.
3. Reattach the RA leadwire to the patient simulator.

Pace Detect Functions

1. With the patient monitor displaying leads I, II, III, and V, set the patient simulator to output a VP1 (ventricular pacemaker simulation #1) waveform.
2. Enable the pacemaker detection function of the patient monitor.
   a. Select *ECG* from the display main menu,
   b. Select *DETECT PACE* and set to *PACE 2*.
3. Verify the heart rate remains at approximately 80 bpm.
4. Select the VP2 output (ventricular pacemaker simulation #2) on the patient simulator.
5. Select and press *RELEARN*.



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6. The heart rate number may disappear from the display for a few seconds and return to the screen shortly thereafter. Verify the heart rate is at approximately 80 bpm. Verify the pacemaker spikes display at the same amplitude.

7. Disable the pacemaker detection function of the patient monitor. Verify the displayed pacemaker spikes have a different amplitude than in the previous step.
8. Select the AVS output (A/V sequential pacemaker simulation) on the patient simulator.
9. Select and press *RELEARN*.
10. Verify the displayed pacemaker spikes are at different amplitudes.
11. Select and press *RELEARN*.
12. Enable the pacemaker detection function of the patient monitor once again.
13. Set *ECG GAIN* to *X2*.
14. Verify a stable heart rate display of approximately 80 bpm. Verify the pacemaker spikes are again at the same amplitude.
15. Disable the pacemaker detection function of the patient monitor.

Pace Detect Functions Do Not Work Properly

If the pacemaker detection test results are not correct, as described above, complete the following steps.

1. Verify the patient simulator functions correctly by testing it on a working patient monitor.
2. If the simulator is functioning correctly, the acquisition PCB is suspect. Swap a working acquisition PCB into the patient monitor and perform this test to verify correct operation.

Invasive Blood Pressure Functions (option)

The invasive blood pressure (BP) test procedure requires the use of the following patient simulator: Multifunction Microsimulator (pn. MARQII or MARQIII). If you need to use a different patient simulator, adjust the procedure steps/readings accordingly.

Setup BP

Connect the Blood Pressure output of the patient simulator to each enabled BP patient connector on the side panel of the patient monitor.

Zero-Reference Enabled BP Input

Properly zero-reference each enabled BP input.

1. Set the patient simulator BP output to 0 mmHg
2. Press the **ZERO ALL (FUNCTION)** key on the patient monitor.

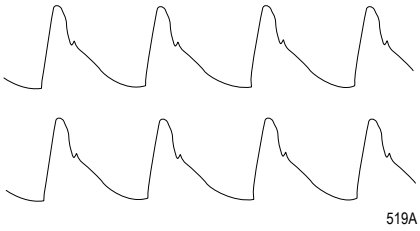
Generate Dynamic BP Waveforms

1. Set the patient simulator BP output to a 120/80 Wave.
2. Setup the BP scales on the patient monitor to best match the waveform output.
3. Repeat steps 1 and 2 for each enabled BP channel.

Verify Dynamic BP Results

Once the BP waveforms are setup as described above verify the following:

- Waveforms are noise-free, as shown in the figure below.



- BP displayed parameters are within tolerance as indicated in the following list:

BP Parameter:	AR1
Systolic (mmHg):	116 – 124
Diastolic (mmHg):	78 – 82

NOTE

These tests are designed for use with a Multifunction Microsimulator, pn. MARQII or MARQIII. Accuracy specifications of the patient simulator in combination with the patient monitor (±2% or 1 mmHg, whichever is greater) is how the parameter values listed above, were derived. Use of any other manufacturer patient simulator, and associated specifications, can potentially change these test results.

Generate Static BP Waveforms

1. Set the patient simulator BP output to 200 mmHg (240 mmHG MARQII or MARQIII), static pressure.
2. Verify the BP channel is working correctly if systolic, diastolic, and mean pressure values for BP are displaying parameter readings between 194 and 206 mmHg.
3. Repeat steps 1 and 2 for each enabled BP channel.

BP Waveforms Do Not Appear Correctly On The Display

1. If the BP waveforms displayed on the patient monitor appear noisy or distorted (example shown below), test the Patient simulator and simulator test cables and on a working patient monitor to determine the source of the problem.

2. If the static pressure test results were inaccurate, test the Patient simulator and simulator test cables and on a working patient monitor to determine the source of the problem.
3. If the patient simulator and associated test cables are determined to be functioning correctly, replace the DAS FRU. See Chapter 7, "Field Replaceable Units"

BP Waveforms Do Not Appear On The Display At All

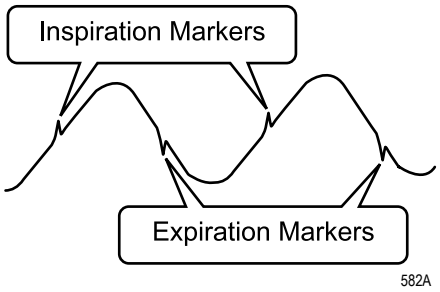
1. If the BP parameter labels, readings and associated waveforms do not display on the patient monitor, verify the patient simulator and associated test cables on a working patient monitor.
2. Inspect the BP side panel connectors on the patient monitor for bent or broken pins. If any pins are bent or broken, replace the DAS assembly.
3. Inspect the dual BP cable connectors on the patient monitor for bent or broken pins. If any pins are bent or broken, replace the DAS assembly.

Respiration Functions

Connect the Multifunction Microsimulator (pn. MARQII or MARQIII) and appropriate patient cables to the ECG/RESP side panel connector on the patient monitor.

1. Adjust the patient simulator to output a respiration waveform using the following settings:
   - Rate BPM – 30
   - Baseline Impedance Ohms – 750 (1000 Ohms MARQII),
   - ΔR Ohms – 2.0.
2. Enable the respiration function of the patient monitor.
   a. Select *MONITOR SETUP* from the main menu display on the patient monitor,
   b. Select *PARAMETERS ON/OFF* from the patient monitor setup menu.
   c. Turn and push the **Trim Knob** control to scroll to and select *RR* in the parameters on/off pop-up window.
   d. Toggle and select *ON* in the RR line of the parameters on/off pop-up window.

3. Verify the following:
   - Respiration rate is displayed and accurate.
   - Respiration waveform is displayed and noise-free.
   - Markers appear in the displayed respiration waveform (see figure below). These indicate the points at which the patient monitor senses inspiration and expiration for determination of the respiration rate.



No Respiration Waveform or Rate Appear on the Display

If the respiration waveform or rate does not appear on the patient monitor display, perform the following steps to isolate the problem.

1. Vary the baseline impedance on the patient simulator
2. Vary the ΔR on the patient simulator.
3. Test the patient simulator and appropriate patient cables on a working patient monitor to determine the source of the problem.
4. If none of the previous recommendations corrects the problem, the acquisition PCB is suspect. Swap the PCB into a working patient monitor to determine the source of the problem and replace as necessary.

Markers do not Appear on Respiration Waveform; Respiration Rate is Inaccurate

If the markers on the respiration waveform do not appear on the display or the respiration rate count is inaccurate, try changing the respiration sensitivity level on the patient monitor. Use the **Trim Knob** control on the patient monitor to select the following menu options.

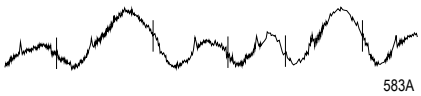
1. Scroll to and select *RR* (respiration parameter) from the patient monitor main menu,
2. Scroll to and select *SENSITIVITY* from the respiration parameter menu, and
3. Scroll to and select a different sensitivity percentage (%) from the sensitivity menu

NOTE

Usually, a lower respiration sensitivity % level rectifies this problem.

Respiration Functions Work Properly on Patient Simulator but not on Actual Patient

Refer to the Operator's Manual for detailed information regarding patient preparation relative to respiration monitoring functions. Achieving optimum results for respiration waveforms and accurate respiration rate detection by the patient monitor requires proper preparation for ECG electrode placement on the patient. Following is an example of a noisy respiration waveform which is usually due to bad patient preparation.



NOTE

With patients that exhibit excessively high baseline chest impedance, proper respiration monitoring can be extremely difficult, if not impossible.

Noninvasive Blood Pressure Functions

Perform the noninvasive blood pressure (NBP) Checkout Procedure found in the Maintenance chapter. This procedure determines whether or not the NBP functions of the patient monitor are working as designed or whether the patient monitor requires NBP calibration.

If, after performing the prescribed checkout procedure, it is determined that there are potential problems that NBP calibration does not cure, try the following:

1. If calibration is unsuccessful and cannot be properly performed, there could be leaks in the pneumatic circuit plumbing. The following steps assist you in determining this.
   - The NBP cuff and tubing is the easiest area to inspect for leaks and is also the most likely area for failure in this regard. Closely inspect these items for cracks or leaks. Test the NBP cuff and tubing on a working patient monitor to determine the source of the problem.
   - If the NBP cuff and tubing are determined to be good after testing them on a working patient monitor, the leaks are probably internal to the patient monitor. Disassemble the patient monitor and check inspect all internal tubing and connections in the pneumatic circuit plumbing.

2. If no leaks are found after performing the previous step, the NBP pump assembly is suspect. Swap the NBP pump assembly with one from a working patient monitor and/or replace as necessary.

NBP Alarms Occur Continuously

If the patient monitor is not configured properly, a variety of NBP problems may occur. To determine patient monitor configuration, rotate then push the **Trim Knob** control to:

1. Scroll to and select *CUSTOMIZE MONITOR* from the main menu of the patient monitor,
2. Scroll to and select *PATIENT-MONITOR TYPE* from the customize patient monitor menu of the patient monitor.

Verify the configured patient monitor type matches the environment in which the patient monitor is being used. If it is set to a neonatal ICU when the patient monitor is used for the adult ICU application or vice versa, problems listed to the left may occur.

Checkout Procedures Completion

This completes all tests associated with the checkout procedures.

1. Discharge the test patient admitted during the "ECG Tests" on page 8-19.
2. Set all test equipment power switches to the off position.
3. Unplug the patient monitor (or docking station) from AC power.
4. Remove all test equipment from the patient monitor (or docking station).

Repair Log

Unit Serial Number:
Institution Name:

Date	Maintenance/Repair	Technician

A Appendix A – Technical Specifications

Technical Specifications

Due to continual product innovation, specifications are subject to change without notice. The following specifications are accurate as of the date of this publication, and pertain to the patient monitor.

Performance Specifications

Display

Size: Dash 3000: Dash 4000: Dash 5000:	 8.4-inch diagonal 10.4-inch diagonal 12.1- inch diagonal
Type: Color:	 Active-Matrix Liquid Crystal Display (LCD)
Resolution: Dash 3000: Dash 4000: Dash 5000:	 640 by 480 pixels 640 by 480 pixels 800 by 600 pixels
Number of traces:	6 (maximum)
Number of seconds/trace: Dash 3000: Dash 4000: Dash 5000:	 4.9 at 25 mm/sec 6.0 at 25 mm/sec 6.9 at 25 mm/sec
Sweep speed: All waveforms	 6.25, 12.5 or 25 mm/sec (with erase bar)
Waveform display options:	Individual 6 waveforms, individual 3 waveforms, full, and full grid modes
Parameter blocks displayed:	Up to ten
Information window:	Displays non-real-time information without obstructing the display of real-time information
Display organization:	Prioritized by parameter

Controls

Standard:	**Trim Knob** control plus 5 hard keys: **Power**, **NBP Go/ Stop** (**NBP Auto** on Dash 5000), **Zero All**, **Silence Alarm/Admit**, and **Graph Go/Stop** (**Print** on Dash 5000).
Optional remote control	**Trim Knob** control and 18 active hard keys.

Alarms

Categories:	Patient Status and System Status
Priorities:	4 levels — Crisis, Warning, Advisory, and Message
Notification:	Audible and visual
Setting:	Default and individual
Silencing:	1 minute, current alarm only
Pause:	5 minutes (adult); 3 minutes (neonatal); 5, 15 minutes, permanent (OR mode)
Volume:	Default 70 dB measured at 1 meter

ECG

5 Leadwire cable:	I, II, III, V, aVR, aVL, and aVF
10 Leadwire cable (12SL option):	V2, V3, V4, V5 and V6
Leads analyzed simultaneously:	I, II, III, and V (multi-lead mode)
Lead fail:	Identifies failed lead
Alarms:	User-selectable upper and lower heart rate limits
Input specifications: Voltage range: Signal width: Heart rate range: Accuracy: Input impedance: Common mode: Differential: Common mode rejection:	 ±0.5 mV to ±5 mV 40 ms to 120 ms (Q to S) 30 to 300 BPM ±1% or ±1 BPM, whichever is greater >10 MΩ at 50/60 Hz >2.5 MΩ from dc to 60 Hz 90dB minimum at 50 Hz or 60 Hz
Output specifications: Heart rate averaging: Frequency response: Display: Diagnostic Mode: Monitoring Mode: Moderate Mode: Maximum Mode: Impulse Response:	 8 beats with a 2-second update rate of display Response of non-permanent displays is limited by resolution to 40 Hz (-3dB) @ 25 mm/s. Specified upper frequency limits may vary by ± 2 Hz. 0.67(+0.4 dB) to 100 Hz (-3 dB) For compliance with China National Standard: 1.0 Hz (+0.4 dB) to 75 Hz (-3 dB) 0.67 (+0.4 dB) to 40 Hz (-3 dB) 0.67 (+0.4 dB) to 25 Hz (-3 dB) 5.0 Hz (-3 dB) to 25 Hz (-3 dB) For an impulse of 3 mV applied for 100 ms: Displacement following impulse: < 0.1 mV Slope following impulse: < 0.3 mV/s

ST segment measurement:	
Measurement point:	Adjustable from 0 to 80 ms past the J-point (default: 60 ms adult, 30 ms neonatal)
Measurement range:	–12.0 to +12.0 mm
Measurement accuracy:	±10% or 0.5 mm, whichever is greater
Pacemaker detection/rejection:	
Input voltage range:	±2 mV to ±700 mV
Input pulse width:	0.1 ms to 2 ms
Rise time:	10 µs to 100 µs
Over/under shoot:	2 mV (max)
Baseline drift:	<0.5 mV/hour with a ±700-mV, 2-ms pacemaker pulse applied

Invasive Blood Pressure (BP)

Number of channels:	2
Transducer sites:	Arterial (ART), femoral artery (FEM), pulmonary artery (PA), central venous (CVP), right atrial (RA), left atrial (LA), intracranial (ICP), and special (SP) In neonatal mode: umbilical artery catheter (UAC) and umbilical venous catheter (UVC)
Transducer requirements: Excitation voltage: Transducer output:	 5.0 Vdc ±0.1% 5 µV/V/mmHg
Input specifications: Range: Offset:	 –25 mmHg to 300 mmHg ±150 mmHg
Output specifications: Frequency response: Zero balance range: Zero balance accuracy: Zero balance drift: Accuracy: Alarms:	 dc to 50 Hz ±150 mmHg ±1 mmHg ±1 mmHg over 24 hours ±2% or ±1 mmHg, whichever is greater (exclusive of transducer) User-selectable upper and lower limits for systolic, diastolic, and mean pressures

Noninvasive Blood Pressure (NBP)

Measurement technique:	Oscillometric
Displayed parameters:	Systolic, diastolic, and mean pressures, time of last measurement
Measurement modes:	Manual, auto, and stat in adult and OR modes; manual and auto in neonatal mode
NBP pressure range: Systolic pressure range Adult: Pediatric: Neonatal: Diastolic pressure range Adult: Pediatric: Neonatal: Mean pressure range Adult: Pediatric: Neonatal:	 30 to 285 mmHg 30 to 235 mmHg 30 to 140 mmHg 10 to 220 mmHg 10 to 210 mmHg 10 to 110 mmHg 20 to 260 mmHg 20 to 220 mmHg 20 to 125 mmHg

Cuff pressure range: Adult: Pediatric: Neonatal:	 294 ± 6 mmHg 250 ± 5 mmHg 147 ± 3 mmHg
Pressure accuracy: Static: Clinical:	 ±2% or ±3 mmHg, whichever is greater ±5 mmHg average error 8 mmHg standard deviation
Heart rate detection:	30 to 200 beats per minute
Total cycle time:	20 to 40 seconds typical (dependent on heart rate and motion artifact)
Automatic cycle times:	0 to 8 hours
Auto zero:	Zero pressure reference prior to each cuff inflation
Tubing length: Adult: Neonatal:	 12 feet 8 feet
Automatic cuff deflation:	Cycle time exceeding 3 minutes (90 seconds neonatal), power off, or cuff pressure exceeds 294 mmHg (±6 mmHg) adult, 147 mmHg (±3 mmHg) neonatal
Cuff sizes: Disposable: Reusable:	 Large adult, adult, small adult, pediatric, small pediatric, and infant Thigh, large adult, adult, child, and infant
Alarms:	User-selectable upper and lower limits for systolic, diastolic, and mean pressures

Bispectral Index (BIS)

Technology	Supports Aspect Medical BIS-x technology
Information Displayed	BIS, SQI, SR and SEF, EEG waveform
BIS Range	0-100
Signal Quality Index (SQI) Range	0-100
Suppression Ratio (SR) Range	0-100%
Spectral Edge Frequency (SEF) Range	0-30
Alarms	User selectable upper and lower BIS limits.

GE Pulse Oximetry (SPO2)

Parameters monitored:	Arterial oxygen saturation (SpO2) and peripheral pulse rate (PPR)
Measurement Range Saturation: Pulse Rate:	 0 - 100% SpO_2 30 - 250 beats per minute
Accuracy SpO2: PPR:	Actual accuracy depends on probe. Please reference manufacturer's specifications. ± 2% (70 - 100% SpO2) ±1 standard deviation ± 3% (50 - 69% SpO2) ±1 standard deviation ± 3 beats per minute
Alarms:	User-selectable upper and lower limits for SpO2 and PPR.

Masimo SET SPO2 Module

Display Messages	*LOW QUALITY, PROBE IS OFF THE PATIENT, PROBE OR MODULE MALFUNCTION, PULSE SEARCH*
Measurement Range Saturation: Pulse Rate: Perfusion:	 30 to 100% SpO_2 25 to 240 beats per minute 0.02 to 20%
Accuracy Displayed saturation data Saturation, no motion: Saturation, motion: Pulse Rate, no motion: Pulse Rate, motion:	 Functional saturation SpO_2 over the range 70 to 100%, below 69% is unspecified ±2 digits for adults and pediatrics, ±3 digits for neonates SpO_2 over the range 70 to 100%, below 69% is unspecified ±3 digits for adults, pediatrics, and neonates 25 to 240 bpm, ±3 bpm 25 to 240 bpm, ±5 bpm
Alarms:	User-selectable upper and lower limits for SpO2 and PPR.
Patents	5482036, 5490505, 5632272, 5685299, 5769785, 6002952, 6036642, 6067462, 5758644; 6206830; 6157850.

Nellcor SPO2 Module

Display Messages	*PROBE IS OFF THE PATIENT, PROBE OR MODULE MALFUNCTION, PULSE SEARCH*
Measurement Range Saturation: Pulse Rate: Perfusion:	 1 to 100% SpO_2 20 to 250 beats per minute 0.03 to 20%
Accuracy Displayed saturation data Saturation, no interference: Saturation, with interference: Pulse Rate, no interference: Pulse Rate, with interference: Unspecified accuracy:	Actual accuracy depends on probe. Functional saturation SpO_2 over the range 70 to 100%, below 69% is unspecified ±2 digits for adults and pediatrics, ±3 digits for neonates SpO_2 over the range 70 to 100%, below 69% is unspecified ±3 digits for adults, pediatrics, and neonates 25 to 240 bpm, ±3 bpm 25 to 240 bpm, ±5 bpm 10 to 19 bpm, 251 to 300 bpm
Alarms:	User-selectable upper and lower limits for SpO2 and PPR.
Patents	4621643, 4653498, 4700708, 4770179, 4802486, 4869254, 4928692, 4934372, 5078136, 5351685, 5421329, 5485847, 5533507, 5577500, 5803910, 5853364, 5865736, 6083172, Re35122.

Cardiac Output (CO)

Availability:	Included in 7020 and 7025 software packages. Not available in 7015 software package.
Input specifications: Probe type: Catheter manufacturers: Catheter sizes: Abbott catheter sizes: Arrow catheter sizes: Baxter catheter sizes: Ohmeda catheter sizes: Other catheter sizes: Injectate volume:	 In-line or bath probe Abbott, Arrow, Baxter, Ohmeda, or other 5.5F (75 cm), 7F (85 cm), 7.5F (110 cm), and 8F (110 cm) 5, 6, 7, or 7.5F 5, 6, 7, 7.5 or 8F 5, 7, or 7.5F Cardiac coefficient entered manually 3, 5, or 10 cc
Output specifications: Parameters displayed: Range: Cardiac output: Blood temperature: Injectate temperature: Accuracy: Cardiac output: Blood temperature: Injectate temperature: Frequency response:	 Cardiac output, blood temperature, injectate temperature, trial number 0.2 - 15 liters per minute 30 - 42°C 0 - 30°C ±5% (liters of blood/min) ±0.2°C ±0.3°C dc to 15 Hz ±2 Hz

Respiration

Measurement technique:	Impedance variation detection
Range: Respiration rate: Base impedance: Detection sensitivity:	 0 - 200 breaths per minute 100 - 1000 Ω at 52.6 kHz excitation frequency 0.4 to 10 Ω variation
Accuracy: Respiration rate	 ±1 BrPM
Waveform display bandwidth:	0.1 to 1.8 Hz (–3 dB)
Alarms:	User-selectable upper and lower respiration rate limits, and user-selectable apnea limit

Temperature (TEMP)

Number of channels:	2
Probe type:	YSI Series 400 or 700 thermistor (determined by input cable)
Temperature range:	0°C to 45°C (32°F to 113°F)
Display resolution:	±0.1°C
Accuracy:	±0.1°C (25°C to 45°C) independent of sensor
Parameters displayed:	T1, T2
Alarms:	User-selectable upper and lower limits for T1, T2

Carbon Dioxide (CO2)

Information displayed:	Inspired and expired carbon dioxide concentrations in %, mmHg or kPa, respiration rate, continuous CO2 waveform
Measurement technique:	Non-dispersive infrared absorption, dual wavelength ratiometric
Sensor type:	Novametrix Medical Systems' Capnostat III
Patient interface:	Compatible with Novametrix Medical Systems' Capnogard monitoring product
Airway adaptors Types: Dead space/chamber volumes: Adult reusable: Adult disposable: Neonatal:	 Adult reusable (standard), adult disposable, neonatal <5 cc <5 cc <0.5 cc

CO2 measurement specifications:	
Measurement range:	
Pi CO2/Fi CO2:	0 to 100 mmHg/0 to 13%
Pe CO2/Fe CO2:	0 to 100 mmHg/0 to 13%
RR:	0 to 120 breaths/min
Accuracy:	±5% of reading or ±2 mmHg, whichever is greater
Display update interval:	2 sec
CO2 waveform sweep speed:	Selectable 6.25, 12.5, or 25 mm/sec
CO2 averaging:	Selectable from single breath, 10 sec, or 20 sec
CO2 measurement stability:	Accuracy maintained over 8 hours
Resolution:	1 mmHg
Noise:	2% of reading or 0.5 mmHg (maximum), whichever is greater
60 Hz interference:	<0.5 mmHg at 38 mmHg
Step response time:	
Adult:	<60 ms (10-90%)
Neonatal	<50 ms (10-90%)
Interference:	
N2O gas:	±5% of reading or ±2 mmHg (maximum), whichever is greater, with N2O compensation enabled
O2 gas:	±5% of reading or ±2 mmHg (maximum), whichever is greater, with O2 compensation enabled
Barometric pressure:	±2 mmHg (maximum) from 500 to 800 mmHg
Water vapor:	±1.5% of reading or ±0.5 mmHg (maximum), whichever is greater
Anesthetic agent:	±0.5 mmHg (maximum) for concentration of no more than 5% of halogenated agents
Airway adapter variability:	±3% of reading or ±1.5 mmHg (maximum), whichever is greater, with same or different adapter; not applicable after adapter zero
Warm-up time:	Less than 15 seconds to initial CO2 indication, full specification within 120 seconds; waveform immediate upon power up
Calibration:	
Factory settings:	Factory calibration settings stored in nonvolatile memory within the sensor; 15 second adaptor calibration when switching airway types
Verification:	Zero and span performance check with on-cable verifier
Respiration rate specifications:	
Range (for 5% step size):	0-120 breaths per minute
Accuracy:	±1 breath per minute
Resolution:	±1 breath per minute
Barometric pressure sensor specifications:	
Range:	530 to 785 mmHg (70.7 to 104.7 kPa)
Accuracy:	±25 mmHg
Alarms:	User-selectable upper and lower limits for CO2 and RR.

Analog Output

ECG:	
Gain:	1 V/mV ±10%
DC offset:	±100 mV (max)
Noise:	<5 mVp-p (0-300 Hz)
Frequency response:	In the "ECG" section, refer to the "Output specifications:" on page -3.
Time delay:	40 ms monitoring filter, 35 ms diagnostic filter
Blood pressure:	
Gain:	10 mV/mmHg ±2%
DC offset:	±20 mV (max)
Noise:	<5 mVp-p (0-300 Hz)
Frequency response:	dc to 50 Hz +2/–0 Hz
Time delay:	40 Hz filter, 37 ms

Defibrillator Synchronization Pulse

Marker out:	
Time delay:	35 ms (maximum), R-wave peak to leading edge of pulse.
Amplitude (selectable in Service menu):	
+5 V selection:	3.5 V (min) at 1 mA sourcing; 0.5 V (max) at 5 mA sinking.
+12 V selection:	11.0 V (min) at 1 mA sourcing; 0.75 V (max) at 5 mA sinking.
Pulse width:	10 ms ±10% or 100 ms ±10% (selectable in Service menu).
Output impedance:	50 Ω nominal
Current limit:	15 mA nominal, both sourcing and sinking.
Marker in:	
Input threshold:	V_{IH} = ±2.5 V (min); V_{IL} = ±1.5 V (max)
Input hysteresis:	650 mV typical
Maximum input voltage:	±30 V (with respect to ground on pin 3)
Input impedance:	10 kΩ (min) for -25 V < VIN < 25 V
Pulse width:	1.0 ms (min), VIN > 2.5 V

Battery

Battery type:	Exchangeable Lithium-Ion
Number of batteries:	up to 2
Battery weight:	0.36 kg (0.8 lbs) each
Voltage:	11.1 V (nominal)
Capacity:	3520 mAh
Charge time:	Less than 4 hours each
Run time: one battery: two batteries:	 2.5 hours 5.0 hours **NOTE** The run time of the battery is dependant upon the following items: ◆ The battery functions at 100% design capacity and full charge capacity. ◆ The monitored parameters are ECG, BP1, BP2, Temp., and SpO_2.
Battery life:	500 cycles to 50% capacity
Storage temperature:	-20°C to 60°C (-4°F to 140°F)

Paper Recorder

Method:	Thermal dot array
Horizontal resolution:	480 dots/in at 25 mm/sec
Vertical resolution:	200 dots/in
Number of waveform channels:	4
Paper width:	50 mm (1.97 in)
Paper length:	30 m (100 ft)
Paper speed:	0.1, 0.5, 1, 5, 10, 12.5, 25, and 50 mm/sec (± 2%)

Wireless LAN

	802.11	802.11b
Transmission technique:	Frequency hopping spread spectrum	Direct Sequence Spread Spectrum
Frequency:	Country dependent, specific settings received from access point. Within 2400 to 2500 MHZ range.	
Radio data rates:	1 and 2 Mbps	1, 2, 5.5 and 11 Mbps
Radio output power:	100 mW (including antenna gain)	100 mW (including antenna gain)
Modulation:	Binary GFSK	BPSK (1 Mbps), QPSK (2 Mbps), CCK (5.5 and 11 Mbps)
Applicable standards:	US: FCC Part 15 Class B Europe: ETS 300 328 and ETS 300 826	US: FCC Part 15 Class B Europe: ETS 300 328 Japan: RCR STD-33

Environmental Specifications

NOTE

The system may not meet its performance specifications if stored or used outside the manufacturer's specified temperature and humidity range.

Power requirements: 100-120 VAC 200-240 VAC	 50/60 Hz 2.0A 50/60 Hz 1.0A
Power consumption:	75 watts (fully loaded)
Cooling:	Convection
Heat dissipation:	240 Btu/hr (max)
Battery operation time: General:	 Battery age will affect operating time.
Operating conditions: Ambient temperature: While charging batteries: With Nellcor Capnostat III sensor: Relative humidity: Vibration: Altitude:	 0 to 40°C (32 to 104°F) 0 to 35°C (32 to 95°F) 0 to 35°C (32 to 95°F) 10° to 40° C (50° to 104°F) 5 to 95% at 40°C MIL-STD 810E, Method 514.4, Category 1 -273.10 m to 2,942.84 m (-896 ft to 9655 ft)
Storage conditions (Do not exceed): Maximum: Minimum: CO2 Sensor: Batteries:	 70°C (158°F) at 95% relative humidity –40°C (–40°F) at 15% relative humidity –30 to 65°C (–22 to 149°F) –20 to 60°C (–4 to 140°F)
Equipment Type:	Portable per EN 60601-1

Physical Specifications

Height:	
Dash 3000	26 cm (10.25 inches)
Dash 4000	27.4 cm (10.8 inches)
Dash 5000	28.7 cm (11.3 inches)
Width:	
Dash 3000	28 cm (11.0 inches)
Dash 4000	29.3 cm (11.5 inches)
Dash 5000	30.7 cm (12.2 inches)
Depth:	
Dash 3000	20 cm (8 inches)
Dash 4000	24.3 cm (9.6 inches)
Dash 5000	23.9 cm (9.4 inches)
Weight (without batteries)	
Dash 3000	5.5 kg (12 lbs) with all options
Dash 4000	5.5 kg (12.2 lbs) with all options
Dash 5000	6.4 kg (14 lbs) with all options

Certification

Safety

UL 60601-1 Classified.
UL classified for CAN/CSA C22.2 No. 601.1
EN 60601-1 Certified EN 60601-2-27 EN 60601-2-30 EN 60601-2-34 EN 60601-2-49 EN 12470-4 EN 865
The Dash 3000/4000 system meets the requirements of EN 60601-1-2
CE marking for Council Directive 93/42/EEC including Medical Devices Directive
Radio and Telecommunication Terminal Equipment Directive

FCC Compliance Information Statement

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

WARNING
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

B Appendix B– Electromagnetic Compatibility (EMC)

Electromagnetic Compatibility (EMC)

Changes or modifications to this system not expressly approved by GE Medical Systems can cause EMC issues with this or other equipment. This system is designed and tested to comply with applicable regulation regarding EMC and must be installed and put into service according to the EMC information stated in this supplement.

WARNINGS

Use of portable phones or other radio frequency (RF) emitting equipment near the system may cause unexpected or adverse operation.

The equipment or system should not be used adjacent to, or stacked with, other equipment. If adjacent or stacked use is necessary, the equipment or system should be tested to verify normal operation in the configuration in which it is being used.

Guidance and Manufacturer's Declaration – Electromagnetic Emissions

The Dash 3000/4000/5000 Patient Monitor is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to assure that the Dash 3000/4000/5000 Patient Monitor is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment – Guidance
RF Emissions EN 55011	Group 1	The equipment uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emissions EN 55011	Class A	The equipment is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions EN 61000-3-2	Class A	
Voltage Fluctuations/ Flicker Emissions EN 61000-3-3	Complies	

Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The Dash 3000/4000/5000 Patient Monitor is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to assure that the Dash 3000/4000/5000 Patient Monitor is used in such an environment.

Immunity Test	EN 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
Electrostatic Discharge (ESD) EN 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical Fast Transient/Burst EN 61000-4-4	± 2 kV for power supply lines ±1 kV for input/output lines	± 2 kV for power supply lines ±1 kV for input/output lines	Mains power should be that of a typical commercial or hospital environment.
Surge EN 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	Mains power should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines EN 61000-4-11	<5% U_t (>95% dip in U_t) for 0.5 cycles <40% U_t (>60% dip in U_t) for 5 cycles <70% U_t (>30% dip in U_t) for 25 cycles <5% U_t (>95% dip in U_t) for 5 s	<5% U_t (>95% dip in U_t) for 0.5 cycles <40% U_t (>60% dip in U_t) for 5 cycles <70% U_t (>30% dip in U_t) for 25 cycles <5% U_t (>95% dip in U_t) for 5 s	Mains power should be that of a typical commercial or hospital environment. If the user of the equipment requires continued operation during power mains interruptions, it is recommended that the equipment be powered from an uninterruptible power supply or a battery.
Power Frequency (50/60 Hz) Magnetic Field EN 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

NOTE:
U_t is the AC mains voltage prior to application of the test level.

Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The Dash 3000/4000/5000 Patient Monitor is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to assure that the Dash 3000/4000/5000 Patient Monitor is used in such an environment.

Immunity Test	EN 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
			Portable and mobile RF communications equipment should not be used closer to any part of the equipment, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF EN 61000-4-6	3 Vrms 150 KHz to 80 MHz	3 V rms	$d = 1.2\sqrt{P}$
Radiated RF EN 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer, and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a], should be less than the compliance level in each frequency range[b]. Interference may occur in the vicinity of equipment marked with the following symbol:

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.
Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by reflection from structures, objects, and people.

[a]Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the equipment is used exceeds the applicable RF compliance level above, the equipment should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the equipment.

[b]Over the frequency range 150 KHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended Separation Distances

The table below provides the recommended separation distances (in meters) between portable and mobile RF communications equipment and the Dash 3000/4000/5000 Patient Monitor.

The Dash 3000/4000/5000 Patient Monitor is intended for use in the electromagnetic environment on which radiated RF disturbances are controlled. The customer or the user of the Dash 3000/4000/5000 Patient Monitor can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Dash 3000/4000/5000 Patient Monitor as recommended below, according to the maximum output power of the communications equipment.

	Separation Distance in Meters (m) According to Frequency of Transmitter		
Rated Maximum Output Power of Transmitter in Watts	**150 kHz to 80 MHz** [a] $d = 1.2\sqrt{P}$	**80 MHz to 800 MHz** [a] $d = 1.2\sqrt{P}$	**800 MHz to 2.5 GHz** [a] $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23
[a]At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.			

For transmitters rated at a maximum output power not listed above, the recommended separation distance [*d*] in meters (m) can be estimated using the equitation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE:

These guidelines may not apply in all instances. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Compliant Cables and Accessories

WARNING
The use of accessories, transducers and cables other than those specified may result in increased emissions or decreased immunity performance of the equipment or system.

The table below lists cables, transducers, and other applicable accessories with which GE Medical Systems claims EMC compliance.

NOTE:
Any supplied accessories that do not affect EMC compliance are not included.

Category	Description	Maximum Length
ECG Cables		
	Multi-Link 12-Ld ECG Standard Cable	3.6 m / 12 ft
	Multi-Link 5-Ld ECG Standard Cable	6 m / 20 ft
	Multi-Link 3-Ld ECG Neonatal Cable	3.6 m / 12 ft
	Multi-Link 3-Ld ECG Cable w/Grabber	3.6 m / 12 ft
	Multi-Link 5-Ld ECG ESU	3.6 m / 12 ft
	Multi-Link, 3/5-Ld ECG Cable	3.6 m / 12 ft
	Multi-Link 3-Ld Neonatal ECG Cable	3.6 m / 12 ft
	Multi-Link 3-Ld ECG Cable w/Grabber	3.6 m / 12 ft
	Multi-Link 6-Ld ECG Cable	3.6 m / 12 ft
	Multi-Link 12 SL ECG Cable	3.6 m / 12 ft
	Multi-Link 3/5/6 Adapter	N/A
	Multi-Link to 300-Series 3-Ld Trunk Cable	3 m / 10 ft
	Multi-Link to 300-Series 5-Ld Trunk Cable	3 m / 10 ft
ECG Multi-Link Lead wires		
	Multi-Link lead wire Set-Group, 5-Ld, Grabber	130 cm / 51 in
	Multi-Link lead wire Set-Group, 3-Ld, Grabber	130 cm / 51 in
	Multi-Link lead wire set, 5-Ld, Grabber	130 cm / 51 in
	Multi-Link lead wire set, 5-Ld, Grabber V2-V6	130 cm / 51 in
	Multi-Link lead wire set, 3-Ld, MiniGrab AHA Ld I	74 cm / 29 in
	Multi-Link lead wire set, 3-Ld, MiniGrab IEC Ld I	74 cm / 29 in

Category	Description	Maximum Length
	Multi-Link lead wire set, 3-Ld, Adult Grabber AHA Ld II	74 cm / 29 in
	Multi-Link lead wire set, 3-Ld, Adult Grabber IEC Ld II	74 cm / 29 in
	Multi-Link Ldwr Set-Group, 5-Ld, Snap	130 cm / 51 in
	Multi-Link Ldwr Set-Group, 3-Ld, Snap	130 cm / 51 in
	Multi-Link Ldwr Set, Mini-Clip/DIN, Neonatal	60 cm / 24 in
	Multi-Link Ldwr Set, 5-Ld, Snap	130 cm / 51 in
	Multi-Link Ldwr Set, Radiotranslucent Grabber	1.6 m / 60 in
	Multi-Link Ldwr Set, 6-Ld, Snap	130 cm / 51 in
	Multi-Link Ldwr Set, Individual, Grabber	130 cm / 51 in
	Multi-Link Ldwr Set, Individual, Snap	130 cm / 51 in
	Multi-Link Ldwr Set, Individual, Grabber, V2-V6	130 cm / 51 in
	300-Series 3-Ld Set w/clips	75 cm / 30 in
	300-Series 3-Ld Set w/clips	1.5 m / 60 in
	300-Series 3-Ld Set w/snaps	75 cm / 30 in
	300-Series 5-Ld Set w/clips	125 cm / 49 in
	300-Series 5-Ld Set w/clips	1.5 m / 60 in
	300-Series 5-Ld Set w/snaps	125 cm / 49 in
	300-Series replacement clip lead	125 cm / 49 in
	300-Series replacement clip lead	1.5 m / 60 in
	300-Series replacement clip lead	75 cm / 30 in
	300-Series replacement snap lead	125 cm / 49 in
Invasive BP Cables and Transducers		
	Utah Transducer Adapter Cable	3.6 m / 12 ft
	Spectramed Transducer Adapter Cable	3.6 m / 12 ft
	Dual BP adapter	30 cm / 12 in
	Utah Transducer Adapter Cable	3.6 m / 12 ft
	Abbott Transpac-III Adapter Cable	3.6 m / 12 ft
	Abbott Transpac-IV Adapter Cable	3.6 m / 12 ft
	Edwards Truwave Adapter Cable	3.6 m / 12 ft
	Spectramed Transducer Adapter Cable	3.6 m / 12 ft
	Utah Disposable Transducers (DPT, DP2, DP3)	N/A
	Spectramed Transducers (TC-MQ)	N/A

Category	Description	Maximum Length
	Abbott Transpac-III Transducers	N/A
	Abbott Transpac-IV Transducers	N/A
	Edwards Truwave Transducers (PX)	N/A
Cardiac Output Cables and Probes		
	Cardiac Output Cable	3.6 m / 12 ft
	Cardiac Output Probe	2.4 m / 8 ft
	Cardiac Output Cable	3.6 m / 12 ft
Temperature Cables and Probes		
	Dual Temp Cable	20 cm / 8 in
	Temp Probe Interconnect Cable	3.6 m / 12 ft
	Dual Temp Cable	20 cm / 8 in
Pulse Oximetry Cables and Sensors		
	Nellcor RECAL Interface Cable	3.6 m / 12 ft
	Masimo SET Interface Cable	3.6 m / 12 ft
	Masimo SET Interface Cable	3.6 m / 12 ft
	Nellcor RCAL Interface Cable	3.6 m / 12 ft
	Nellcor OxiMax Interface Cable	3 m / 10 ft
	Nellcor OxiMax Interface Cable	1.2 m / 10 ft
	Masimo Finger Sensor, Pediatric	N/A
	Masimo Finger Sensor, Adult	N/A
	Masimo Sensor Finger Probe	N/A
	Durasensor DS-100A, Adult	N/A
CO2 Cable		
	CO2 Sensor Cable	2.4 m / 8 ft
Accessories		
	Power Cord	1.8 m / 6 ft
	Power Cord	1.8 m / 6 ft
	Battery Lithium-Ion	N/A
	RJ45 series Category 5 cable	N/A
	DASH Port 2	N/A
	CapnoFlex LF CO2 Module	N/A
	UNITY Network ID to Dash Cable	1.5 m / 5 ft

Category	Description	Maximum Length
	Remote Control	N/A
	UNITY Network ID	N/A
	AUX Adapter	N/A
	RAC 2A	N/A
	SAM Module	N/A
	ICG-BIOz Hemodynamics Module	N/A
	ICG Patient Cable	4.8 m / 15 ft
	Dash Responder	N/A
	15 inch Medical Grade Flat Panel Display	N/A
	18 inch Medical Grade Flat Panel Display	N/A
	15 inch Medical Grade Flat Panel Display	N/A
	Digital Video Cable	1.8 m / 6 ft
	Durasensor Adult DS-100A Individual Probe	

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